PERMANENT WAY—CROSS-TIES.

The growing scarcity of material for making good cross-ties and their enhanced cost has been one of the principal causes of the increased expense of track repairs during the past five years, and there is no prospect of a decrease in prices. The ever-increasing mileage of newly-constructed roads largely decreases the timber acreage and swells the total mileage of the permanent lines, which demand an immense and unstinted annual supply of cross-ties for renewals.

Twelve years ago the average number of oak ties which could be obtained from one acre of timber was 220, and extra good woodlands have yielded as many as 270 ties per acre. To-day the tiemaker is extremely fortunate when he finds a wood lot that will yield an average of 160 per acre; and good tie-producing timber is scare and high-priced in most of the States having a large railway mileage.

To give some idea of the immense annual supply of cross-ties required for the railways in the United States we have compiled the following statistics: There are about 119,000 miles of railway in operation in this country at the present time, which have an average of 2,816 cross-ties per mile of track—making a total of 335,104,000 cross-ties now in use. Allowing 160 as the average yield per acre of woodland, the number now in use upon the railways in the United States represents the stumpage of 2,094,400 acres of land, and during the next six years this amount of timber land will be levied upon to renew the existing 335,104,000 cross-ties at a cost of $167,552,000. An area of territory equal in size to two-thirds the area of the State of Connecticut is required to supply the railways of this country with cross-ties for the ensuing six years.

As many good trackmen know, there are economical considerations pertaining to the use and care of cross-ties which are not generally observed. Proportionately there is as large an opening for the extravagant use of cross-ties in the track as in other items of maintenance of way. We have heard section foremen say: "Give me plenty of wood under the rails and I will give the company a good track." True enough they can do so and at a greater or less expense to the company; but the section foreman must not be charged with all the extravagance in this respect. So far as he prolongs the life of the tie while under the rail and in his care, giving it the best chances for durability, he should be credited therefor; but if the ties are inferior in make and quality they will be short-lived under the best of care and these shortcomings are chargeable to the tie-inspector or purchaser, or both.

Undoubtedly the number of ties used to a rail length of 30 feet affects their durability. Fifteen ties to the rail are as few as should ever be used, and this number may be sufficient for a road having a medium light traffic, but the rail should weigh 60 pounds per yard. A majority of roads use 17 ties to the rail and are none too many for a road doing a heavy traffic on a 60-pound rail. When there is a scant number used, the narrow ties are forced into the ballast and the broader ones sooner or later crushed. In spacing ties it is better to do so according to their respective widths. When a tie is less than the average width the space upon each side of it should be less than between those that are wider. A narrow one should not be placed next to an excessively broad one, otherwise a depression in the rail will occur. A tie of medium width should be inserted between them. The rule of the maintenance of way department of a road may be to place ties 20 inches apart, measuring from centers along the rail; in the aggregate length this may be correct, but unless the ties are of a uniform width and thickness the rule cannot be strictly applied, nor is it necessary to do so. An old tie should not be taken from the track unless it is broken in two or commences to crush. It is even better to let it remain without disturbing its bed, for it is well tamped, and make room for a new sound tie by the side of it, leaving space, of course, between the two for tamping. The new tie will hold the track to gauge and both old and new will carry the rail and its load—giving elasticity of road-bed. If a tie is never taken from the track until it is broken, there is no necessity for the road-master to go over the road upon the useless task of inspecting old ties. A tie is worth something as a bearing for the rail long after it refuses to hold a spike. If the crushed or broken ones are carefully excluded there will never be an excess of rotten ties under the rails, nor enough to cause an accident.

A tie that curves horizontally or one that curves vertically should never be placed on the road-bed; by making inequalities in the track they cause a waste of time and labor. When ties do not give a level bearing to the rail they should be adzed off broadly at the ends, as much as is necessary, not making a channel in the tie for the rail and at the same time a receptacle for moisture. It is reasonable to suppose that ties will last much longer if they are placed in the road-bed with the sapwood or bark side downwards. The wetting and drying process, which hastens the decay of all wood when laid upon the ground, affects the sapwood more seriously than it does the matured inside portions of a tree; besides the heart of the wood is firmer and holds the spike better against the shearing strains from the flanges of the rails.

Another important reason why they should be placed with the sap downwards is that they are less liable to warp. An entirely green tie should never be placed in the road-bed. The moisture from the earth takes the place of the sap or juices of the wood as they recede from it, thus taking up the first conditions of decay, while the tie not only warps badly, but if the upper surface dries out in the sun and wind it will check badly; consequently such a tie is never in a sound condition, and is extremely short lived. It is claimed by some that a hewn tie will last longer than one that is sawed. If there is any such difference it lies in the fact that the surface of the sawed tie is rough, and holds a great deal more moisture than the smoothly-hewn tie, and that the process of the hewing tends to close the pores of the surface of the wood. Sawed switch-ties which have been placed in the road-bed with hewn ties, both of oak, have lasted equally as well. There are other facts concerning the longevity of these which should be considered: First, a tie-maker knows that it does not pay to hew ties from poor timber; secondly, a saw-mill tie-maker will saw up anything he can sell. It is bad practice to stand ties upon end while seasoning them. The end of the tie which rested upon the ground decays soonest, and the result is a kink in the rail which rests upon it, the wood not being firm enough to hold the spike to its place. Ties, when once piled in this manner, generally remain so long after they are seasoned, until they are needed in the track, consequently as soon as the sap leaves the ties they commence to absorb moisture from the earth by capillary, and thus go into the track, having one end in an advanced condition of decay.

There is money saved in having ties stripped of their bark and piled in tiers to season, each tie lying transversely with the one below—the lower tier resting above the ground upon blocks of wood.—*Railway Review.*

SYSTEMATIC PRESERVATION OF DRAWINGS.*

Having been on several occasions requested by members of this society to give some account of the system of working drawings established by the writer in the machine works with which he is connected, he will commence by saying that the need for this system developed itself gradually during a number of years, and in connection with a great variety of different kinds of work. Hundreds of drawings had accumulated, being of all degrees of goodness and badness—chiefly the latter. They were principally noticeable for having no two of the sheets of paper of the same kind or size, and for having but few border lines—the views of the objects shown often extending entirely to the edge of the sheet, and sometimes to imaginary realms beyond. As usual with such documents, they were kept in a manner highly conductive to the development of ragged and dirty edges and obliterated pencil lines, for it should be remarked that many of them were entirely guiltless of ink. Being made in such a very miscellaneous way, they of course had upon them no consecutive numbers, and unfortunately the dates had oftentimes been forgotten, there being no particular place provided for them to serve as a reminder. The name of the article shown was usually written somewhere upon the face, and sometimes (if it was a transient job) the name of the customer for whom the work was to be made. They were of various different scales, and in many cases mere sketches to no scale at all. Bad as this system, or lack of system was, it probably was a fair sample of the methods in vogue in half the machine shops in the United States.

SIZES OF DRAWINGS.

In providing a remedy for the evils above depicted, the first thing was to adopt a set of sizes for the sheets of paper, and as it was necessary to have a great many small drawings of punching dies and such articles, the smallest size was fixed upon as 4½ by 6 inches. There were five other sizes, viz., 6 by 9, 9 by 12, 12 by 18, 18 by 24 and 24 by 36. It will be noticed that these sizes were all multiples of the first, and that each sheet was just the size of two of the next smaller sheets placed side by side. One reason for this was that the paper would cut conveniently and without waste; another, that two or four sheets might be placed together when desired, in one of the glass-covered frames (in which they were kept for shop use), of a size or two larger than their own frames, in which they would be placed singly. These frames were made in six sizes, to suit the drawings, which, by the way, were known as sizes A, B, C, D, E and F, respectively, beginning with the smallest. They were made much like a picture-frame would be if it had a solid back-board about ¼ inch thick and one of the side moldings hinging outward, being held, when shut, by two small brass hooks. The drawing, and a pane of glass above it, were shoved in sideways when this hinged piece was open. This arrangement permitted the use of unvarnished drawings—a great advantage where many of them are of a transient nature, and where it is often necessary to use them the first time in an unfinished condition.

MANAGEMENT OF OLD DRAWINGS.

The next move was to bring all the old drawings before referred into the new system, by mounting them upon suitable sizes of heavy paper (clipping them down smaller wherever practicable) and putting upon them the proper labels. These were inscribed as will be hereafter explained, and were placed diagonally in one corner of the sheet. This position was used so that they could be read when either one side or one end of the sheet was placed upward, thus enabling advantage to be taken of the oblong shape of the paper (a shape adopted for this reason) in arranging views so as to occupy the least amount of space—according to the character of the object shown. After being properly numbered, these old mounted drawings formed the beginning of a series, which has since been, and is still, daily increasing.

KEEPING THE DRAWINGS.

The next thing done was to provide a large fire-proof safe, with numerous shallow drawers, subdivided to fit the various sized sheets, to hold all drawings not in use. A general classification of subjects was then adopted: *e. g.*, one class embraced all kinds of presses, another all dies, another drilling machinery, etc. Each of these classes was known by a letter of the alphabet prefixed by the word "class." All articles not important enough to be classed alone went into a class "miscellaneous." Besides this classification, all drawings belonged to one or two grand classes, known as "standard" and "transient." In the former were placed drawings of all articles which had been so perfected and for which there was such a commercial demand as to warrant their being duplicated and made up as stock for the market. To the latter belonged drawings of any work got up especially for particular customers—also standard drawings which for any cause have become obsolete. The transient drawings were, of course, usually of a cheaper character than the "standards," often being mere free-hand sketches.

NUMBERING.

The numbering of the sheets was purely consecutive in order of their being made, regardless of their size or classification. Their position in their drawers was in order of magnitude of numbers, counting from bottom to top, though frequently not by consecutive numbers in any one pile. They were indexed as fast as made in a book with columns arranged respectively for number, name, size letter, class letter and marks denoting standard or transient. From this "blotter" index, as it might be termed, are "tested" all standard entries into classified or "ledger" index made of large cards hung up inside the safe. The transients were not posted, as they could be easily enough found for the few occasions when wanted, by referring to a special column in the order-book headed "sheet number." This number it was the duty of the head draftsman to enter opposite every item of every order which was filled by the house. Of course in a majority of cases these were numbers belonging to standard drawings. By adhering rigidly to this rule and holding the draftsman referred to strictly responsible, a perfect record of all work may be kept, providing drawings are never altered, of which more further on.

Of the mechanical quality of the particular set of drawings whose history is here recounted, high praise cannot be spoken. Many have been made very hastily, and many left incomplete on account of experimental work requiring frequent changes and improvements. They can, however, where defective, be inked, shaded and otherwise finished up; and as time is found for doing it many of them will be destroyed, and substitutes made bearing the same numbers and containing the same information, even though they need not necessarily be *fac similes*. The system by which they are kept is believed to be as excellent in theory as it has proved itself in practice. It aims to be thoroughly comprehensive, and to be so elastic as to permit of an unlimited growth of business as well as numerous changes in the character of the products delineated in the drawings.

Regarding the technical rules adopted for the making and figuring of the drawings themselves—that is, their mechanical construction—there is hardly space here to write. Possibly they may be of sufficient interest to appear in some future paper. I will only say here, that in placing the different views the method by "direct revolution" is strictly adhered to.

LABELS.

The labels before referred to are inscribed with the size-letter, the sheet number, the name of the

*A paper by Oberlin Smith, M. E., read before the Society of Mechanical Engineers at New York meeting, Nov. 2, 1882.

house owning the drawings, the date, the class-letter and the name of the article delineated. If standard, the word "standard" is also inscribed. in the case of "transients," the name of the customer and the number of his order, together with the number of the "special job" in the time book to which time is charged, are also inscribed. The labels are printed, with proper blanks left to be filled by hand. They are triangular, in order to occupy as little room as possible in the corner of the sheet

A vital feature of this system, and the one on which its value as a true record of work done depends, is a strict adherence to the spirit (though not the letter) of the rule never to alter a drawing in the slightest degree after it has once received a number. An infraction of this rule throws all records into confusion, as a drawing is referred to by its number, not only in the commercial books of a house, but on numerous other drawings. Yet, to keep this rule literally involves a complete new drawing, costing perhaps much time and many dollars, every time the slightest change is made in the machine or other object which it delineates. This matter of altering drawings is probably the most perplexing subject with which the designer of machinery has to deal—especially if he happens to possess an "improving" disposition and is not content with a new machine (or cannot induce the public to be content with it) until it has been altered a score of times. To illustrate how crudely this difficulty is dealt with, even in some of the best shops, I might cite the case of a certain large and well-known engine works, most excellently and systematically conducted, where the only resource, in case of any alteration being desired, is to make the same in red ink upon the original black drawing, leaving the black lines intact as a record of the first construction. In case of a second alteration, I believe their practice is to alter again in red, but how the second construction is recorded I do not know. This method is certainly very objectionable, not only on account of its providing for but one alteration and because it makes a confusion of lines, but because the red ink should be reserved for dimension lines and other explanatory matter which is not a part of the construction.

ALTERATION OF DRAWINGS.

In the system under consideration the difficulty is surmounted by taking a drawing from its place and altering it in whatever way desired, giving it a new number, date, etc., and treating it in every way exactly as a new drawing—regarding the old drawing merely as so much material out of which to manufacture the new one. Furthermore (and this is vitally important), a substitute is at once provided for the old drawing, bearing an identical label (except perhaps regarding size of paper) and representing it in all respects. It may be asked, Where is the economy, if the substitute must be like the original? It need not be, only it must contain exactly the same information. This is accomplished by showing upon it, usually by a mounted tracing, a perfect copy of all such parts as have been altered, and also a written inscription thus: "Otherwise like sheet" so-and-so—naming the number of the newly "manufactured" drawing. To give an illustration of the above; suppose it is found desirable to alter a machine of which a drawing is shown upon "sheet 100." A tracing or other copy is made of the parts to be altered, together with enough of the contiguous lines to identify its position. This is mounted and labeled just like the original sheet, except that, perhaps, an economy of paper and storage has been attained by using a much smaller size of sheet, in which case the "size-letter" must be changed in the indexes. It is then found, perhaps, that the last drawing made was "sheet 999." The old "sheet 100" is then altered and its proper consecutive number, "1,000," is affixed. The words "otherwise like sheet 1000," or their equivalents, are then written upon the new sheet "100," and the transaction is complete. It has been found practicable to thus "throw forward" a sheet several times without confusing the records. Sometimes it has happened with a 24 by 36-inch sheet, which has gone forward and left behind it as substitutes only a few 4½ by 6-inch sheets, containing rapidly made sketches or tracings.

It should be mentioned that in case duplicate drawings are required, they bear the same number as their originals, with the word "duplicate" affixed.

It should be borne in mind that the essential parts of this system are the consecutive numbering, the indexing, the substitution of a copy (or of references which make it equivalent to a copy) for all altered drawings, and a uniformity in size and labeling. The dimensions of paper and the classification into kinds are matters that may be modified to suit the taste and needs of the user.

THE WYANDOTTE (KAN.) WATER-WORKS will be capable of furnishing a population of 75,000. It is proposed to extend the works and invest an additional $50,000.

ARGYLL ON HOUSE DRAINAGE.

From the London Standard, July 19.

At the Kensington Town Hall, a meeting of the London Sanitary Protection Association was addressed on Tuesday evening by the Duke of Argyll, who said the society urged the well-to-do householders of the country to take certain measures, which they believed to be necessary for the health of themselves and their families. The society was an insurance society, and was better than the ordinary ones, for whereas they paid sums of money to the families upon the death of the head of the family, the society of which he had the honor of having been elected the President hoped to prevent death for many years, and to give increased length of life to the members. [Cheers.] Their object was to put into the hands of the householders of the country, in a cheap and easy method, the power of knowing according to the best scientific methods whether or not their houses were in a healthy sanitary condition. That object was carried out by means of reasonable fees, varied according to the rent of houses. The society endeavored to associate householders together, so that whenever occasion for alarm arose at the condition of their drains they might have the services of one of the society's engineers to report upon the condition of those drains and the remedial measures expedient to be taken. The evil which the society proposed to remedy was one of the most deadly and insidious dangers existing in this civilized community. Persons were very serious when they heard the word poison mentioned, but they usually thought of poisoned food addressed to the human system through the stomach; but the poison of that kind was much less dangerous than that addressed to the lungs. [Hear, hear.] In the former case there was a much greater chance of detecting the evil and remedying it; but as to the poison addressed to the lungs, there was often no warning whatever of the danger until the system was in many cases so thoroughly poisoned that health was lost for the rest of their lives. Frequently, valuable lives were thus lost, and happy homes and families laid desolate. The climate of this country, whatever else may be said against it, was almost entirely free from the terrible outdoor malaria which prevailed in many Continental countries. But we kept all our malaria for our own domestic houses, although we were free from it in the open air. The motto of the society was that prevention was better than cure, and, more than that, prevention was very often easy when cure was wholly impossible. [Cheers.] There were no diseases more deadly than some of those due to the foul air of drains. Those who succumbed the quickest to those terrible diseases were often young men with powerful frames. The causes of these diseases were perfectly ascertainable by medical science. The danger was aggravated by our system of drainage, for, until very recently, we were all living upon the top of enormous gas-holders of foul air. The drains were simply bottles of gas with no outlet except from the pipes which led into the houses. Those gas-holders of foul air, pouring their breath into the houses, must exercise a terribly bad influence upon the health of those who breathed it. [Cheers.] Mr. Bright had said it was absurd to suppose that we could not defend the hole which was to form the entrance to a channel tunnel, but the fact was we could not defend a hole a few inches square which let into our houses a far worse enemy than any that would come through the channel tunnel. [Hear, hear.] It was to provide a remedy for the evils of that character that the society had been established. Prof. Fleeming Jenkin, Mr. E. C. Robins, Lord Chelmsford (who said he had recently taken a house, and by the aid of the society's agents, had ascertained that not one of the drain-pipes underneath the house had been inspected), Prof. Huxley and others addressed the meeting.

IN AND OUT OF WALL STREET.

New York is almost as bad as Paris in its tendency to get excited over any public event, and just as suddenly to forget all about it. It takes a great deal of time and hard hitting to stir up an Anglo-Saxon, a Dutchman, or a German; but when they have been once stirred, there is no stopping them until the business is settled. Royal Commissions, Parliamentary Commissions, public meetings, every imaginable machinery is put to work, and kept going sometimes for years and years. The power of the so-called vested interests in England, Holland and Germany is so strong that anything likely to affect it becomes a matter of deep public concern. In France they upset a system of government and forget all about it in a fortnight; while in Great Britain they fight for years and years over the deceased wife's sister or the ritualistic candles. In this country the only lasting contest is between Republicans and Democrats, for it is the only one that represents vested interests, in the way of office patronage. Everything else is forgotten as fast as it comes up, and no one seems to care what the morrow will bring. A big railroad smash or steal sets everybody talking against corporation law, but in a day or two everything is condoned again. A strike of several thousand workmen against a despotic and exacting monopoly upsets all the telegraphic communications of the country; but in about a week or ten days nobody cares any more for the issue, except those actually engaged in the contest. This go-as-you-please way of looking at things has its invigorating influence upon a young nation, but it is fraught with a great danger. It gives the chance to some one question to grow unnoticed and ripen into an all-absorbing national contest. It was so with the slavery question. It may be so with the labor question. Keen students of social topics have been predicting for some time past that it is in this country that the great struggle between capital and labor will break out and become most fierce. It is much safer for a great community to have scores of small bones to fight over than to have one big one to contend for. In this respect Europe is much better protected from a cataclysm than America. Petty quarrels and differences from the spice of family life can hardly ever lead to scandal; but one big question usually breaks up the whole establishment.

Who had ever heard of Frank Phillips? Yet everybody has seen what his whistle did to the telegraph business. Who can vouch that the day is not near by when there will be a Frank Phillips' whistle in every branch of industry?

Railroad magnates and monopolists of all kinds try their best to brace up and pooh-pooh all signs of the time. But the number of intelligent men of means who can read the writing on the wall is daily growing larger and larger, and the best proof of this is the general decrease of confidence in corporate institutions. Of course the fraudulent and watering practices of our railroad magnates have done a great deal toward disgusting investors. But this is true only as far as the general public is concerned. Between it and the magnates of the financial world stands a strong phalanx of solid capitalists, who are always welcome in the inside rings of the manipulation. To them is constantly offered a chance to enter some new or reconstructed enterprise, upon bed-rock terms, and to receive ten or twenty thousand dollars in paper for every thousand dollars they put up in cash. Yet they are now almost invariably refusing to go in, for they apprehend that the time may not be far off when this kind of paper will be worthless. This is the reason why all attempts to float new corporate enterprises fail nowadays. Hundreds of millions of securities have lately been listed upon the Stock Exchange, but they are unsalable, and remain in the treasuries of the respective companies. And they are likely to remain there till the great speculative edifice is thoroughly cleaned and whitewashed inside, and more or less reasonably protected against a war between labor and capital outside.—*N. Y. Sun, July* 30.

RAILROAD BUILDING IN CALIFORNIA.

A great deal of railroad building is at present going on in California. The following list has been compiled from official sources: First comes the extension of the Oregon Branch of the Central Pacific Railroad. 1. The road from Redding to Bailey's (Lower Soda Springs) will be sixty miles in length. The line runs along the Sacramento River, closely following its highest mark, through a canyon country, compelling costly construction and numerous crossings. The country back from the river rises into broken mountains, covered with brush and of but little value. Settlers are few, and engaged only in mining and stock raising. The minimum grade of this section is seventy feet per mile. 2. The road from Bailey's to Berryvale (or Sisson's) will be thirteen miles in length. The line rises away from the river toward the summit, requiring above Berryvale a steady upgrade of 116 feet per mile. It follows the east side of the Sacramento Canyon. The country is heavily timbered, fir predominating, and has but few inhabitants. 3. The road from Berryvale to Black Butte Summit will be seven and four-fifths miles. It runs over bench lands, timbered and comparatively smooth, with occasional meadows, all of which are cultivated and occupied. Black Butte Summit is on the ridge or divide between the waters of the Sacramento and Klamath rivers. 4. The road from Black Butte Summit to Shasta River (near Butteville) will be eight and two-fifths miles in length. The line descends into the Shasta Valley, through land of a hilly rather than a mountainous character. The country is well timbered, being covered with pine and fir. The district is sparsely settled. 5. The road from Shasta River to the head of Willow Creek will be thirty-three miles in length. The line runs through the Shasta Valley, which is from ten to twenty miles wide. The land is mostly level, destitute of timber, and well adapted to stock raising. Quite a number of settlers are located there, the chief industry being the dairy business. 6. The road from the head of Willow Creek to the Klamath River will be two miles in length. The road, as surveyed, runs through a

canyon, down a grade of ninety feet to the mile. The country is hilly, bare of timber, and contains but few settlers. 7. The road from the Klamath River to Fox's, on Cottonwood Creek, will be eight miles in length. It runs over a good country, which is well settled, the principal business being farming and stock raising. The district is bare of timber. The road from Fox's to the State line will be 7½ miles in length. The survey here passes up Cottonwood Canyon, on a grade of 116 feet to the mile. There is some timber on the land, principally pine and fir. In the district there are few valleys and hills, suitable for pasturage. The total mileage of this Oregon Branch of the Central Pacific Railroad will be 139¾ miles.

Next comes the San Joaquin Valley & Yosemite Railroad. The road from Berenda to the end of the survey at Perry's Ranch, will be 25 7/10 miles in length. For the first thirteen miles the road runs over rolling plains; the remainder is through a broken foot-hill country.

Next is the Winters & the Ukiah Railroad. From Vacaville (four miles from Elmira, on the California Pacific Railroad) the survey was commenced toward Clear Lake, distant, at the town of Lakeport, 70 miles. The survey has been completed 42 miles. It runs through a mountainous country, although there are numerous small valleys suitable for grazing and cultivation. Next comes the Northern Division of Southern Pacific Railroad. From San Francisco to Soledad the distance is 148 miles. From Soledad to the junction with the main line in Tulare Valley the road will be 161 7/10 miles in length. From the junction on the main line to San Francisco, via Soledad, the distance is 304 4/10 miles—via Martinez 291 4/10 miles. The proposed road from Soledad to the junction with the main line in Tulare Valley will run southerly for about sixty-four miles up the valley of the Salinas River. This valley contains some good agricultural land, with high hills on each side, affording pasturage. The line then turns eastward up the valley of the Estrella and San Juan creeks, crossing the coast range of mountains at an elevation of over 1,000 feet into the Tulare Valley, across which it will run easterly for about forty-seven miles to the junction with the main line. South of Tulare Lake the country is low and swampy for a considerable distance, caused by the overflow of Kern River and Tulare Lake. The agricultural land in the Salinas Valley will require irrigation. When irrigated, as is the case with much other land in California, it becomes extremely productive.

A NEW WAY OF REMOVING A BLUFF.

[From the Sioux City Journal.]

The hydraulic machinery which has been brought to this city to be used in washing away the threatening bluffs which hang over the track of the Milwaukee road two miles west, was put to a test yesterday. The best possible arrangements for undertaking the difficult work have been made. From the Worthington pump, which is considered the more powerful of the two on the boat, an 8-in. pipe extends up the bank to a height of about 60 feet, where it reaches the road-bed of the track. It then runs under the track nearly to the base of the bluff and terminates in a movable iron nozzle, with a 2-in. end. From the point where the nozzle is directed toward the bluff begins a sluiceway constructed of boards and about two feet deep. This sluiceway leads under the track, downward in a diagonal course to the river. The pipe through which the water rushes to the nozzle is well secured. The sluiceway is constructed on timbers, and is strongly braced. As the nozzle points toward the bluff, without the water rushing from its mouth and the sluiceway is dry, there is nothing particularly curious or interesting in the machinery's appearance; but when the big boiler at the water below begins to puff the powerful pump commences action, and the glittering stream shoots from the mouth of the nozzle with lightning speed, and, hardly spraying, strikes the bluff with terrific force, boring deep into the earth and causing the dust to rise in clouds, some appreciation of the force of the water can be gained. Then, too, the practical result of the aqueous battering-ram's power is seen in the mass of mud which rushes through the sluice. Hundreds of tons of earth, made soluble, melts away in an hour and are swiftly carried off through the apparently small board runway to the river below. When the pumps started yesterday afternoon it was just 2:30 o'clock. General Superintendent Clark, General Master Mechanic Lowrey, Assistant Master Mechanic Campbell and Division Superintendent Jackson were present, directing the movements of about thirty men who assisted the machinery in its work. As spectators, fully fifty gentlemen from this city were also on hand, watching with great interest the action of the water on the bluff. At the boat below J. M. Finch, of Milwaukee, who superintended the putting together of the hydraulic machinery, and Engineer Joseph Powell, of Yankton, waited for the signal to "set her going." The boiler showed 120 pounds of steam—a full head. The sluiceway was inspected and strengthened. S. Coleman, of this city, stood at the nozzle, clad in a rubber suit, while four assistants were near the nozzle, similarly protected from the water and ready with shovels and hoes to clear the sluice at its mouth from obstructing masses of turf or dirt. When all was ready the signal was given and the water began to rush through the pipe and pound away at the bank. In five minutes immense quantities of the dirt were melting and rushing through the sluice. The cutting was done in a scientific manner. First, the water was sent against the bluff sixty feet up, and holes bored to weaken its dry solidity. Then the boring began underneath, and the foundation of a mass of earth sixty feet high and ten feet thick by about fifty feet in width was dug away. All at once the big chunk gave way and with vast clouds of dust and much noise fell downward and toward the track. The plucky pipe-man and his assistants were the least disturbed by the slide and advance of the earth, but they had cause for alarm, as for an instant it looked as if a large part of the bluff would be affected by the movement of that detached and would break loose to sweep everything before it to the river. During the hour, while the crowd of visitors remained, a much larger quantity of earth was washed away than was expected when the work commenced, and the officials generally seemed to be satisfied that at last an effective way of conquering the dangerous bluff had been found. It being understood that General Superintendent J. T. Clark was the proposer of the hydraulic method of cutting away the bluff, and that principally through his efforts it has been brought to a practical test, he was briefly interviewed. He expressed himself much pleased with the result of the experiment as far as it had gone. He added that it was only an experiment, but that it looked to him as being much more effective than blasting or shoveling, while the ultimate expense would not be half so great. Just at that moment, as if to furnish him an example to illustrate by, a blast of giant powder was fired about 300 ft. down the track by two men who had been working two hours to put it in and get it ready to fire. The quantity of dirt which came down was inconsiderable, and it did not need explanation to show that the blast only displaced the dirt, but did not move it. The advantage of the hydraulic over every other system is that the dirt is carried away as fast as washed down. The only difficulty in the way of carrying the work to a successful conclusion all along the line of the bluffs may be found in the places where the bluffs are very near the track and precipitous. The obstacle in that event is to carry away the earth as fast as it caves down. Some means of overcoming this may be found. At any rate, for the point of attack chosen at present, the hydraulic engine and the shooting stream of water seem to be about what is needed.

RIVER AND HARBOR IMPROVEMENTS.

Reports of the progress of work in the improvements of rivers and harbors have been received in Washington.

The report of Capt. Thos. H. Handbury, of the Corps of Engineers in charge of River and Harbor Improvements, upon the Arkansas River, has been received at the War Department. From the report it appears that improvements were made during the fiscal year ended June 3, 1883, upon the Arkansas River, the White and St Francis rivers, Arkansas, the Arkansas River at Pine Bluff, Ark., the Arkansas River between Fort Smith and Wichita, Kan., White River, between Jacksonport and Buffalo Shoals of the Arkansas, White River above Buffalo Shoals, Ark., L'Anguille River, Arkansas, Fourche La Feve River, Arkansas, Black River, Arkansas, Black River, and Missouri, Saline River, Arkansas, and Current River, Missouri. A number of surveys were made during the year, $21,213 were expended, and it is estimated $57,000 could be profitably expended, during the fiscal year 1885 in continuing the work.

The report of Maj. A. M. Miller, of the Engineer Corps, shows that improvements were made upon the following named Rivers and Harbors: Mississippi River, second district, from the foot of island No. 40 to the mouth of White River, Ark.; Mississippi River and Harbor of Memphis, Tenn.; Mississippi River and Harbor of Vicksburg; Mississippi River at Natchez and Vidalia; mouth of Red River, La.; removing a raft in the Red River and closing bayou, La.; removing obstructions from Red River, La.; upper Red River, Ark.; from Fulton to head of raft; Red River, La.; Yazoo River, Miss.; Big Sun Flower River, Miss.; Tallahatchie River, Miss.; Coldwater River, Miss.; Tschoula River, Miss.; Yallabusha River, Miss.; Big Hatchie River, Tenn.; South Fork, Deer River, Tenn.; Ouichita River, Ark. and La.; Bayou Bartholomew, La. and Ark.: Texas River, La.; Boeuf River, La.; Cypress Bayou, Tex. and La.; water gauges on Mississippi River and its principal tributaries. During the year $411,659 were expended, and it is estimated that $261,500 can be profitably expended during the next fiscal year aside from work required in Memphis harbor.

The report of Lieut. Col. D. C. Houston, of the Corps of Engineers, shows that improvements were made at the following named places: Fox and Wisconsin rivers, Wis.; harbor of refuge, Milwaukee Bay, Milwaukee harbor; Racine harbor, Wis.; Waukegan harbor, Ill.; Kenosha harbor, Wis. During the last fiscal year $194,099 were expended, and $926,000 is the estimated sum required for the fiscal year.

Major Alexander Mackenzie's report of operations upon the upper Mississippi River shows that improvements were made at the following points: Curve River, Mo.; Mississippi River from St. Paul to Des Moines, rapids of the Mississippi River at Louisiana, Mo.; Mississippi River at Hannibal, Mo.; Mississippi River, near Alexandria, Mo.; Mississippi River at Quincy, Ill.; Quincy Bay, Ill.; and a number of other points. Among the estimates for the next fiscal year are included $95,000 for a dry dock at Des Moines Rapids, $50,000 for improvement of the Mississippi River from Des Moines Rapids to the Illinois River, and $1,000,000 for improvement of the Mississippi River from St. Paul to Des Moines Rapids.

SMALL WASTAGE ON A LARGE AMOUNT OF WORK.

The annual settlement of accounts of the Philadelphia Mint for the last fiscal year closed July 6. Representatives of the Treasury Department have for more than a week been weighing up enormous amounts of gold and silver on hand, and arrived at the actual loss in the operations of the institution for the period named. The result of the examination discloses the fact that the wastage of gold and silver in the operations of last year were the smallest on the amount of bullion operated upon in the history of the Mint. The total amount of gold bullion operated upon during the past year was 2,210,944 32/100 ounces, equal to 76 tons. The total amount of silver operated upon was 45,591,338 72/100 ounces, equal to 1,563 tons. The gold coinage for the year consisted of 415,486 55/100 ounces, equal to 14 tons, the value being $7,729,982.50. The number of gold pieces struck and issued was 941,680. The total silver coinage issued weighed 10,551,908 80/100 ounces, equal to 362 tons, value $12,325,470.15. The number of pieces of silver coined was 18,798,076. The total minor coins issued weighed 7,315,135 89/100 ounces, equal to 251 tons, value $1,428,397.16. The number of minor coins was 60,951,526.

The legal wastage allowed by law on the gold operated during the year was $32,018.33. The actual wastage was $20.77, showing the wastage on gold to be $31,997.56 less than the legal allowance. The legal wastage on the silver allowed by law was 57,293 75/100 ounces, equal to $57,295.05, at $1 an ounce. The actual wastage on silver worked was 809.23 ounces, equal to $809.23, or $56,483.82 less than the legal allowance. In other words, the actual wastage at the Mint upon the operations on the precious metals was $830.12, while the legal allowance was $89,311.88.

INTERESTING TORPEDO EXPERIMENTS AT NEWPORT.

NEWPORT, Aug. 1.—Commodore F. A. Roe, U. S. N., and the other members of the Naval Board appointed to witness the examination of the officers undergoing instructions in the uses and manufacture of torpedoes, arrived at the torpedo station this morning, and were met by the commandant, Capt. Selfridge, who escorted them to headquarters. A salute of eleven torpedoes was fired in honor of Commodore Roe. The torpedoes had been placed in somewhat shallow water, and the result was that each volume of water was sent to a height of from 75 to 125 feet. Experiments of a very successful character were made with gun-cotton torpedoes of twenty-seven pounds and fifty pounds respectively, both striking the objects and scattering the huge barrels into splinters. A seventy-five-pound gun torpedo and a twelve-pound exercise gun torpedo were fired with precision and success. Lieut. Lilley improvised a torpedo and directed it against a barrel, parts of which were sent in all directions. The most interesting feature of the day was the experiment with the Lay-Haight torpedo. This is operated at will by means of a keyboard on the shore. When everything was in readiness it was made to back out to see that everything was in working order. The keyboard was operated by Lieutenant-Commander Newell. The torpedo ran swiftly out at a speed of eleven knots an hour, was made to stop instantaneously, and to go starboard, port, or go ahead by the simple touching of the several keys. Having been operated in this way several times, it was made to describe a complete circle and then come back to the starting point at an eight-knot speed. The experiment was considered the most successful ever made.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page 357.*)

DXLIX.—FORT SNELLING, MINN.

Fort Snelling, Minnesota, in lat. 44° 53′ 25″ N., long. 93° 11′ 30″ W., is at the junction of the Mississippi and Minnesota rivers, on a rolling prairie, about 100 ft. above the rivers. It was established as a military post by the U. S. Government in 1820. Water-works were built in 1882 by the Quartermaster's Department of the Army, after plans of Capt. Edward Maguire of the U. S. Corps of Engineers, taking the supply from a spring, the water of which is retained by a stone dam 5 ft. high and 2½ ft. thick, coated on both sides with Weems patent stone. The water is pumped 56 ft. into a tank, by a Blake steam pump of 16 in. steam and 9 in. water cylinder. The ordinary pressure is 100 lbs. and fire pressure 150 lbs. Distribution is by 2 miles of 6 in. cast iron pipe, with 11 fire hydrants, 6 gates and 28 taps. Service pipes are of lead.

The population in 1880 was 352.

The consumption is not given, nor are any financial statistics furnished. The works are operated by the Quartermaster's Department of the U. S. Army, under direction of Captain Charles Bird.

DL.—AMSTERDAM, N. Y.

Amsterdam, New York, in the lat. 43° N., long. 74° 10′ W., is on rolling ground on the Mohawk River.

Water-works were built by the village in 1882, after the plans and under the superintendence of Stephen E. Babcock, C.E., taking the supply by gravity from streams northwest of the village. McQueen Creek, with a drainage area of 2.89 square miles, is dammed by a stone masonry dam four ft. high, which diverts its flow into an 18 in. stoneware pipe conduit for two miles, with a fall of 18 ft., continued for 1,000 ft. by a 12 in. pipe with a fall of 38 ft. to the channel of Bunn's Creek.

Rogers Creek, with a drainage area of 2.38 square miles, is dammed in like manner and the flow diverted into a 15 in. stoneware pipe, after passing through an open cut 1,000 ft. long. This pipe discharges into a tributary of McQueen Creek, above the dam.

A storage reservoir is formed on Bunn's Creek which has a drainage area of 2.57 square miles at the north line of the village, by an earth dam with rubble masonry head wall 2½ ft. wide on top and 15 ft. wide on bottom. The dam is 410 ft. long and 50 ft. high, with top width of 12 ft. and slopes of 2 and 1½ to 1. The surface of the water is 296 ft. above Main street.

Distribution is by 12 miles of cast iron pipes of 14 to 4 in. in diameter, with 94 gates and 68 fire hydrants. The works being just completed, the number of taps and the consumption cannot be determined.

The works have cost to May 1883, $197,000. The bonded debt is $182,000, at 5 per cent. interest. The works are managed by a board of nine Commissioners. A. Clark is President, and J. McClumpha, Jr., Secretary.

REPORT ON THE METRIC SYSTEM TO THE BOSTON SOCIETY OF CIVIL ENGINEERS.

The committee reported at the annual meeting, held March 21, 1883, that they had early applied to the International Committee of Weights and Measures at Paris for information concerning any difficulties that might have been encountered in the obligatory introduction of the metric system in European countries that have already adopted that system. Dr. Hirsch, Secretary of the International Committee, replied in substance as follows: That in most of the countries interested no serious difficulties have been met with, the people becoming used to it sooner than expected; the cost to governments and private parties is largely compensated by increased advantages and facilities. The chief fault found in Switzerland was that the transitory period in which old and new systems were optional was extended over too much time; the same fault was remarked in Germany and Austria.

The committee give a brief sketch of the history and purpose of the International Bureau of Weights and Measures.

An international convention was first held in Paris in 1867, to consider the subject of a unification of weights and measures and moneys. This committee found the prototype standards of the metric systems deposited in the Palace of the Archives in Paris in a satisfactory state.

The propriety of constructing new prototypes was presented to the British Association for the Advancement of Science in 1869; and in the following year a memorial upon the same subject was addressed by the European Geodetic Association to the French government. France then invited all friendly nations to appoint delegates to an international conference, to consider all the questions that had been raised in regard to the metric system; to settle all uncertainty regarding its basic units; and to provide means for preserving unaltered forever the standards of the system. Thirty states, including the United States, responded to this invitation, and the delegates first met in Paris in 1870. Interrupted by the Franco-German war, the convention did not again assemble until 1872, when, after carefully examining the original standard metre and kilogram, they found them correct and resolved that their values should be preserved in the construction of new standards.

In making these new standards, the convention resolved to employ an alloy of 10 per cent. of iridium with 90 per cent. of pure platinum, and to give the bars a cross section resembling a combination of the letters X and H, the lines denoting the limits of the standards to be traced on the bottom of the trough thus formed, on one side of the cross bar of the H. A committee of twelve members was appointed at this meeting to receive and safely keep the newly prepared standards, and to act within certain limits for the commission in the intervals of their sessions.

In May, 1875, a metric convention, between sixteen states of the old and new world, met and provided for the institution of an international Bureau of Weights and Measures, to be maintained by a *pro rata* appropriation by the several assenting nations. The expenses for the year 1881 of this Bureau were about $20,000. The Bureau is established near Paris, in the Park of St. Cloud.

The direction of the Bureau is committed to an international committee, in which no country can have more than one representative. This committee holds office for six years, one-third going out every two years. The General Conference—made up of the representatives of all the powers by whom the International Committee is elected—meet in Paris every six years, more frequently if occasion arises. The International Committee reports annually to the powers represented.

After referring to the progress of the metric system abroad, and giving a list of the countries using it, the committee reports as follows upon the United States:

Its use was made compulsory in the Marine Hospital service in April, 1878, and the metric system is also adopted in the Medical Department of the U. S. Navy

The U. S. Post-office Department has used the system in its foreign service for several years.

The metric system is used in the U. S. Mint. The recent subsidiary silver coins are made of metric weight. The dime weighs 2.5 grams, the 20-cent piece 5 grams, the 25-cent piece 6.25 grams, and the 50-cent piece 12.5 grams. The 5-cent nickel coin weighs 5 grams. Thus 80 silver half-dollars weigh 1 kilogram; 6 dimes, or 3 twenty-cent pieces, or 3 nickels, weigh 15 grams, which is the unit weight for foreign letter postage.

In the U. S. Coast and Geodetic Survey the metric system has always been in use; and in the U. S. Lake Surveys the system has been extensively used for several years.

The Committee is not aware of any noticeable change in the practice of the U. S. Custom-houses.

The medical profession, in the U. S. Pharmacopœa, have ordered that all definite expressions of weight shall be in both apothecaries' and metric weights.

In conclusion, the committee believes that the metric system can be best introduced by educating the children to its use in the schools.

The above is but an abstract of this interesting report. We must refer those who wish to read it in full to H. G. Prout, the secretary of the Association of Engineering Societies, No. 12 Barclay street, New York, who has the report for sale.

ENGLISH ENGINEERING SOCIETIES.

We have received from the Institution of Civil Engineers the following excerpt minutes of their proceedings: "Weights of Structures, Estimated Graphically," by Jos. H. W. Buck: "Wire-rope Street Railroads in San Francisco and Chicago," by Wm. Morris; "Some Further Tests of Steel Plates for Boiler Work," by Chas. H. Moberly; "Long-distance Telephony," by Geo. M. Hopkins; "Slip-way for Pleasure Boats on the River Thames," by Chas. Jas. Moore; "The Behavior of Steam in the Cylinders of Locomotives during Expansion," by Daniel Kinnear Clark.

From the Society of Engineers we also have a bound volume of their transactions for 1882. The papers submitted during the year include: "Notes on Electric Light Engineering," by C. H. W. Briggs and W. W. Beaumont; "Railway Tunneling in Japan," by T. M. R. Jones; "The Fell Engines, New Zealand," by R. F. Alford; "Ice Making Machinery," by Carl Pieper; and "The Strength of Flues in Lancashire and Similar Boilers," by W. Martin.

BOOK NOTICE.

MUNICIPAL AND SANITARY ENGINEERS' HANDBOOK. By H. Percy Boulnais, M. Inst. C. E. London: E. & F. N. Spon, 1883. Price, $5.

The author of the above desires to fill a long-felt want by furnishing the English borough engineer with a practical book of reference upon the various subjects connected with his duties. The book is well adapted to fill this place, and it will also be useful to the city engineers of the United States, though in a much less degree, because of the different conditions and customs prevailing in the two countries. Considerable space is given to quotations from the Public Health and other acts which regulate the duties of English municipal engineers, and govern the design and execution of most of the works placed in their charge. The subjects are treated in a clear style, and arranged so as to make reference tolerably easy. There are but few illustrations.

The chapters on Traffic and Roadways contain a large amount of valuable information, and constitute one of the best short treatises of the subject that we know of. Macadam, stone block, wood and asphalt pavements each receive due consideration, and while the data refer to English roads, for which more labor is spent than we can ordinarily afford in this country, they show the direction toward which we should improve our own. A special chapter is devoted to the requirements of road metal and its breaking; another to the rolling of Macadam. The maintenance of the different classes of roads and its cost, as well as that of construction, receive proper attention. Chapter XI. treats of Footpaths, and the following one of Curbing and Gutters.

We are then given the necessary data, about 20 pages, concerning the lighting of streets, in which electricity is given its deserving place, and where the main features to be considered in placing the lamps, notes about the necessary brilliancy, etc., are given.

Street naming and numbering, the breaking up of streets for laying pipes, etc., the obstructions caused by projections from houses, by trees, scaffolds and surface water from premises and other topics are well treated, and we think for the first time in the same practical shape. We also find a guide, though of slight use to us, through the various English laws governing the improvement of private streets, the establishing of new streets, and the erection of buildings. Chapter XIX treats of scavenging, street cleaning and watering, the collection of garbage, ashes and refuse, with items of cost, etc., and methods of disposal.

Several chapters are then given to sewerage and sewage disposal. In view of the fact that, as the author says, "a great number of books have been written on the subject of sewerage, and much valuable information has been published from time to time, it always seems superfluous to say much on the subject," and he accordingly gives only a few and very general remarks upon it. He maintains the position that the question

of combined or separate system must be decided according to the elements furnished by each town, and says that the mistake hitherto made has been to try to absolutely separate all rainfall from the sewers. Similarly, with regard to the disposal of sewages, "no hard and fast lines can be laid down as to the best method to be adopted for the disposal of the sewage of any town, but the peculiar circumstances of each case must be considered before advice could be given on the subject: geographical position, physical arrangement, habits of the population, and the character and quantity of the sewage of the town, being some of the most important." The chapter on house drainage contains mostly English laws and regulations governing the same. A few chapters are finally devoted to the subjects of public conveniences, abattoirs, markets, cemeteries, mortuaries and pleasure grounds.

The value of the book is increased by its containing specimens of forms and blanks relating to the business of the surveyor with citizens, contractors and corporations, and also by occasionally giving brief specifications for the carrying out of the works.

A NEW POCKET MANUAL FOR MECHANICAL ENGINEERS.

John W. Hill, Mem. Amer. Soc. C. E. and a well-known Mechanical Engineer, has edited a "Pocket Manual for Engineers," which is published by Wm. A. Harris, builder of the Harris-Corliss Steam Engine, at Providence, R. I.

This little volume of over 200 pages contains a vast deal of information of especial value to the Mechanical and Hydraulic Engineer. While the formulæ, tables, etc., usually found in engineers' pocketbooks are not wanting, Mr. Hill has placed in the remaining portion of the work some matter not used in this class of books. The selections of heads is a happy one, covering more especially the field of mechanical and hydraulic engineers; the descriptive matter under each head is given in much detail, and the tables are collated from the latest authorities, and are very full.

In addition to the data relating to Specific Gravity, tensile and compressive strength of materials; wire hemp rope; shafting, steel springs and much other information useful to the engineers, we note quite elaborate articles on steam boiler explosions in flour mills; combustion and composition of fuel; chimneys, furnaces and boilers, pumping engines and duty tests, and boiler and steam engine trials.

The book is well printed, type and figure-work is clear, double leaded, and easily read. We feel assured that the Manual will be popular among engineers, as it provides in a handy form much that is now only to be had in bulky and expensive volumes.

REPORT OF THE R. R. COMMISSIONERS OF MISSOURI.

The eighth annual report of the Railroad Commissioners of the State of Missouri for the year ending Dec. 31, 1882, has just been received. From it we make the following extracts:

Twelve new companies were organized in 1882. Among the most important combinations of existing lines within the State were the perfection of the lease of the Missouri, Kansas & Texas to the Missouri Pacific, and the sales of the St. Louis, Arkansas & Texas and the Joplin roads to the St. Louis & San Francisco Co. Since the close of 1882, however, the whole Wabash system has been leased to the St. Louis, Iron Mt. & Southern, which last road is owned by the Missouri Pacific Co., and the Hannibal & St. Joseph road has been sold to the owners of the Chicago, Burlington & Quincy.

The total miles of road completed in 1882 in the State was 260.97, and at the close of 1882 the total miles in operation were 4,501.58. There is only now 195.75 miles of narrow-gauge (3 ft.) road within the State, all other lines are standard, being either 4 ft. 8½ in. or 4 ft. 9 in. There are 81 main and branch lines in the State, operated nominally by twenty-six companies. Since the lease of the Wabash lines, and the sale of the H. & St. J. Co.'s stock, six leading companies control 94½ per cent. of all the railroad mileage in the State, and receive 98⅞ per cent. of all the earnings of the same. The Missouri Pacific alone controls 48.9 per cent. of all the lines, and receives 60¼ per cent. of all the earnings.

The total gross earnings inside the State, as far as the same can be separately ascertained, is $27,616,659, equal to $6,305 per mile of road operated during the year. The total expenses amount to $17,875,000, equal to $4,082 per mile of road. The total net earnings amount to $9,741,659, equal to $2,198 per mile of road, and to 35 per cent. of gross earnings.

THE PANAMA CANAL FINANCES AND CONTRACTS.

The fourth general meeting of the Panama Canal shareholders was held in Paris on July 17. We give a condensed translation from the report in the *Bulletin de Canal Interocéanique* of such portions as refer to the contracts entered into. The expenses up to June 30, 1882, amounted to 53,731,651 francs.

The contract with Messrs. Couvreux & Hersent was signed March 12, 1881. These gentlemen divided their task into two periods—that of organization, and that of execution. Having satisfactorily carried out the first part, the contractors wrote to the President of the company that they were ready to undertake the second part of the work at fixed prices, to be regulated by a special agreement. But the contractors believed that it would be more advantageous for the company to accept the bid of the European and American sub-contractors for partial contracts. Such a system would allow of a collective effort and of various methods. In giving their services in making contracts and in stepping out, as it were, Messrs. Couvreux and Hersent had abandoned their own profits to a great extent. They wrote to the President that it was unnecessary to appoint a committee, and that they would be satisfied with a premium, fixed by the president. Taking the amount of expenses to Dec. 31, 1882, the President found that the contractors were entitled, by the terms of the contract, to 1,200,000 francs. He added, however, that by strict justice they were entitled to a commission on *materiel*, that would not be paid until the accounts of 1883 were closed. The proposal of the President was accepted by the contractors, M. Hersent continuing to remain as consulting contractor. The report states that American contractors now take a preponderating position in the execution of the canal; and, from the progress and the preparation made, it is thought that the maritime canal of Panama will be completed in 1888.

The general superintendent of works, M. Dingler, carries on the excavation of the canal, the making of harbors, dams, etc., as far as possible simultaneously. The entire length is divided into sections. That of Colon is exceptionally important, owing to the harbor improvements and buildings. This section, from Colon to Gatun, is in the hands of Messrs. Huerne, Slaven & Co., who will soon have three dredges at work, which they believe will excavate 9,000 cubic metres of earthwork per day.

The section of Bubio-Soldado is in charge of Artigue and Sondregger, who engaged to excavate 1,400,000 cubic metres of the canal for a distance of 2½ kilometres. A contract is under way for the San Pablo section.

The Gorgona section has four divisions. M. Percepied has contracted to excavate 1,200,000 cubic metres in fifteen months. M. Thirion has taken the contract for cutting 1,500,000 cubic metres in eighteen months in the Matachin District. In the Obispo section several contracts have been let out, the principal being that with M. Murraccioli, for excavating 2,000,000 cubic metres within twelve months, and that with Bona frères, for 500,000 cubic metres, within fourteen months. Work at Imperador is under the direction of M. Jacquesmin, for interested parties. The contract for Culebra was revoked, owing to delay on the part of the contractors, but a new one will soon be concluded with other parties. In the Upper Rio Grande section some preliminary work in turning off the river has been given to M. Piantanida. The sections of Paraiso and the mouth of the Rio Grande is undertaken by the Société Franco-Américaine. The first part of the apparatus for this company was shipped from New York on July 1. It is believed that 15,000 men will be set at work at the beginning of the next campaign.

A LIFTING BRIDGE A FOR DOUBLE-TRACK RAILWAY.

We are indebted to John A. Partridge, late Engineer Syracuse Division of the N. Y., W. S. & B. R. R., for a photograph and description of a somewhat peculiar bridge erected by the above-mentioned company over the Oswego Canal, at Syracuse, N. Y.

The bridge was designed by Albert Lucius, C. E., to meet local conditions not admitting of the use of a pivot bridge. It may be described as a triple cancellation riveted Warren girder, top and bottom chord made of plates and angles; it is a double-track through bridge, and in plan is askew, forming an angle of 38° with the center line. The dimensions, etc., are as follows:

Extreme length of truss	94 feet.
" height "	23 "
" width of bridge	30 feet 4 inches.
Weight of bridge with machinery	146 tons.
" of counterweights	138 tons.
Height of lift from bridge seat	10½ feet.
Time required to lift	30 seconds.

At each end of the bridge, starting from the bridge seat, are two latticed iron columns, each braced at the top in the line of truss by a latticed iron brace, and both columns and braces are tied together by light trusses across the track; these columns are apparently about 12 or 15 ft. higher than the truss when resting on the bridge seat. On top of each of the four columns are two iron sheaves of large diameter, and running over each sheave is a steel wire cable 1¼ inches diameter; these two cables are fastened at one end to the upper part of the end post, and at the other to an equalizing yoke in the center of the counter-weight.

The lifting is done by means of four double threaded steel screws, each 3½ in. diameter and 2 in. pitch; these screws are attached to brackets riveted to the tops of the four latticed columns described, and are freely suspended in their upper bearings. A bracket riveted to each end post and upper chord of the bridge carries a phosphor-bronze nut which forms the center of a bevel gear through which each screw passes.

The nuts are actuated by bevel gearing at the ends of line shafts placed on the upper chord of each truss. Two plate girders resting on the top chords of the bridge support a platform which carries two 8×8-in. engines coupled at right angles. These engines drive the shafting and a single revolution gives the nuts a half turn and lifts the bridge one inch.

The counter-weights are boxes made of wrought iron; they slide in guides attached to the outside of the main posts supporting them.

The bridge was built by the Hilton Bridge Co. of Albany, and the machinery was designed and constructed by C. H. Delamater & Co., New York.

THE MISSISSIPPI RIVER JETTIES.—Capt. W. H. Hevier, Corps of Engineers, in his annual report of the progress of the work on the improvement of the South pass of the Mississippi River, says that there is now a channel at least 160 ft. wide, and having a least depth of 26 ft. of water in it, from the Gulf into the main river. Surveys made during the year beyond the ends of the jetties, extending out to 100 ft. depth of water, show very little change to have occured on what is sometimes called the bar. At the head of the South Pass there is now a fine channel, 400 ft. wide and having a least depth of 30 ft. The channels at the head of the Southwest Pass and Pass à l'Outre are also increasing in depth, but the bars at the mouth of these passes are reported as being very shoal. That at Southwest Pass is reported as having only a 12 ft. channel through it, while Pass à l'Outre bar is said to have only 8 ft.

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NOTICES OF MEETINGS.

AMERICAN INSTITUTE OF MINING ENGINEERS.

The Autumn meeting of the Institute will be held in Troy, N. Y., during the second week in October. This meeting will be mainly devoted to the reading and discussion of papers.

Members who wish their papers fully discussed at the meeting can have them printed and circulated in advance, if they are sent to the Secretary early in September.

THOMAS M. DROWN, Secretary.
R. W. HUNT, President, Troy, N. Y.

COVERED SERVICE-RESERVOIRS.—Wm. Morris, C. E., in a late excerpt from minutes of proceedings of the Institution C. E., treats at length of the subject of covered service-reservoirs, describing and illustrating a large number as actually built in England, Germany and Austria. It is followed by an interesting discussion by R. Rawlinson and other noted engineers.

MINERAL PRODUCTS OF THE UNITED STATES.—A work with the above title is now in press and will be shortly published by Albert Williams, Jr., Chief of the Division of Mining Statistics and Technology, United States Geological Survey, Hon. J. W. Powell, Director. The report is for the year 1882 and the first six months of 1883. It will contain detailed statistics for these periods and also for preceding years, together with much technical and descriptive matter.

EXPERTS TO EXAMINE PHILADELPHIA STREET PAVING.—An ordinance was passed by the Philadelphia City Councils, May 28, 1883, authorizing the Mayor to appoint a Board of Experts to report on the present system of paving in that city, and to devise a better system. The American Society of Civil Engineers, the Engineer Corps U. S. A., and the Franklin Institute are to furnish the names of six engineers, two to be selected by each body, and from these the Mayor is to select one from each body to constitute the Board of Experts. The compensation is fixed at $1,000 for each member, to include expenses. The Franklin Institute has instructed its Board of Managers to comply with the request.

THE PANAMA CANAL.

We translate this week from an authoritative source, the fullest statement of the present conditions of affairs on the Isthmus that we have yet seen published.

The French have undoubtedly commenced this work with the intention of completing it, and with a lively and proper sense of the immensity of their undertaking. While little or no progress has yet been made on the canal itself, the provisional work already accomplished and that now under way is quite as important in attaining the end desired. The country to be traversed by the canal can supply literally nothing but a location to meet the demands of this vast enterprise; and this location none of the best for a canal without locks; the climate is a deadly one to imported labor. Hence the wisdom and necessity of first providing a port with all the appliances for handling material; storehouses for containing and protecting these supplies; work shops for setting up and repairing machinery; homes for the well, and hospitals for the sick.

In the face of serious natural and climatic obstacles the French have already accomplished much, and from the energy displayed we do not doubt the final completion of a ship canal at Panama. Whether all the original features of the scheme will be carried out, the future alone can decide.

While the author of the orignal article is evidently none too friendly to American contractors, and is somewhat jealous of foreign interference in what he naturally considers a purely French project, he writes in spirit of fairness and truth in describing the work and stating progress, and as one fully acquainted with all the details of the undertaking.

THE MISSISSIPPI JETTIES.

Captain W. H. Hevier, U. S. Engineers, has submitted his annual report on the progress of the work at the South Pass. There is now a channel at least 160 feet wide, and not less than 26 ft. deep, from the Gulf to the main river. This is a decided improvement on any previous year. But eighteen days' dredging were done during the year. The 30 ft. channel has much inproved during the year; for a small portion of the year the narrowest part in this channel was only 15 ft. in width; this has increased, until now the narrowest width anywhere is 90 ft. The improvement is attributed to the construction of the inner jetty, 6,810 ft. long, built parallel to, and about 200 ft. inside, the east jetty; this inner jetty reduces the width of water way between the jetties to 630 ft.; before wing dams, cribs and minor jetties were built, this width was 1,000 ft.

In September of last year a cyclone did much damage to the east jetty, breaking up badly one-half mile in length of the concrete wall, and displacing concrete blocks of 28 tons in weight; the channel, however, remained uninjured.

Surveys made during the year beyond the Eads jetties to a depth of 100 ft., show very little change to have occurred.

No work was done on the Baron jetties proper during the year; the inner jetty and five wing dams have been built, one of the latter at Crave Island, three near Goat Island, and seven in all near Bayou Grand, varying from 20 to 250 ft. in length.

There are now five channels at the head of South Pass, 400 ft. wide, and 30 ft. in greatest depth.

The channels at the head of Southwest Pass and Pass à l'Outre are increasing in depth, but bars at the mouths of these passes are reported as being very shoal. That at Southwest Pass is reported as having only 12 feet channel through it, while à l'Outre bar is said to have but eight feet. Both these passes are now used so seldom that little is definitely known about them: During the year 10 vessels grounded in the pass or near the jetties, but inspection found that except in rare instances they were out of the channel, which was amply wide, deep and practicable. The appropriations for excavations and surveys is reported to be insufficient to continue work beyond Dec. 1, 1883. During the last fiscal year $10,290 was expended in making these surveys. An additional appropriation of $6000 is required for the present fiscal year, and $17,589 for the fiscal year ending June 30, 1885.

PHILADELPHIA HARBOR IMPROVEMENTS.

From the report of Lieut.-Col. Godfrey Weitzel concerning the river and harbor improvements in the vicinity of Philadelphia, we glean the following:

The Delaware River.—11,428 cu. yds. of material was removed from the channel of the Delaware, between Trenton and Bridesburg, leaving a balance of 60,000 cu. yds. to be removed. The estimate for the year ending June 30, 1885, is $35,000; appropriation was $136,000, of which $11,000 was expended in the improving of Smith's Island bar. The amount available for present year is $121,289.92. Near Cherry Island flats two cuts have been made on the west and east side, with an available width of 470 ft. and 24 ft. deep; $100,000 will be required to continue this improvement.

Schuylkill River.—Between the mouth and Girard Point the width has been increased 274 ft., with a depth of 24 ft.; from Girard Point to Gibson's Point there now exists a channel 150 ft. wide and 20 ft. deep, and from Gibson's Point to Chestnut Street Bridge there is 18 ft. It is recommended to increase the width of the 24 ft. channel to 400 ft. from the river mouth to Girard Point piers, and from there to Gibson's Point to 250 ft; 418,000 cu. yds., at an estimated cost of $160,000, will have to be removed to secure this desired width of channel.

Chester Creek.—10,613 cu. yds. of material was removed during the year.

Frankford Creek.—35,178 cu. yds. was removed in this improvement in last fiscal year. No attempt has been made here by the city of Philadelphia to enforce well-planned shore-lines or prevent encroachment upon the water-way by land-owners. Ashes and cinders are dumped by manufacturers on the banks, and finally find their way into the stream. No permanent improvement is possible as long as the present narrow shore-lines exist, or until the city authorities properly regulate these lines. No further appropriations are recommended.

Delaware Breakwater.—$550,000 are asked for for this improvement, $250,000 for the next fiscal year.

Iron Pier at Lewes, Del.—for the completion of this pier, $12,000 is asked for.

Ice Harbor at Head of Delaware Bay.—$331,090 is estimated as required to complete this work, of which $100,000 could be profitably expended in next fiscal year.

MISSOURI AND YELLOWSTONE RIVER IMPROVEMENTS.

Capt. James B. Quinn, U. S. Engineers, in his annual report to June 30, 1883, states that nothing was done on the Missouri River below Bismarck in the last year; between Fort Benton and the latter place the channel has been improved through difficult reaches.

For the river below Bismarck, light and temporary constructions are recommended; owing to the lack of stability in the banks, lasting improvements cannot be expected. Capt. Quinn urges ample appropriations for the improvement of the Missouri River, which is navigable for 2,000 miles between Sioux City and Fort Benton. Thirty-two million pounds of freight were shipped by steamboats above Bismarck in the past year, $37,919 was expended during the past year, and $39,500 is asked for a continuance of the work.

On the Yellowstone River, improvements were confined to the vicinity of Glendive, Montana, and consisted of building dams to confine the water to the main channel. The resulting scour has materially deepened the water over previous shoals. Ten thousand eight hundred and sixty-six dollars was expended in the past year. One hundred thousand dollars could be profitably employed in the next year, according to the estimate of the Engineer.

THE OPPORTUNITIES FOR INVESTORS.

The buying up of land along the lines of projected railways has of late become as important work to investors in railway enterprises as the building of railways. When a road is first projected, the prospective traffic capacity of the section through which it is to pass is carefully considered. It is the custom, and a very good one too, to buy up large sections of land, agricultural, timber or mineral, for the purpose either of development, or of holding, to be sold at an advance when the road shall bring its tide of population. In this way a new road at once creates a heavy increase in land values, and the foundations are in this way being laid for enormous fortunes for the long-headed investors who are quick enough to perceive advantages of this kind. While in the far West small land owners are increasing, large holders of land are taking possession of the most desirable sections east of the Mississippi. This is a necessity created by the influx of foreign population and the restless movements of our own population along the Atlantic slope. The announcements of the formation of land syndicates are quite frequent, and capital is seeking employment in this direction more than ever before. For instance, the other day a number of New York capitalists effected an organization in the State of Indiana, with a

capital of $12,500,000, for the purpose of constructing 500 miles of road from the city of Chicago to the Ohio River. The scheme of the company is a great one and a wise one. They will construct a network of roads connecting coal mines and now undeveloped producing territory with the lakes and the Ohio River and with other railroads. The chief purpose of this syndicate is to develop the vast coal territory of Indiana, and to place the coal section of that State within cheap and easy reach of the expanding markets. At the present time the coal section of Indiana is but very feebly developed, and the demand for its superior block coal is increasing. The company will economize cost of transportation over existing rail methods, and thus secure markets now beyond the reach of existing facilities, by the construction of steam colliers and steam tugs and barges for the transportation of coal on all navigable rivers of the United States. In short, the company see that, by the proper expenditure of money, they can transport Indiana coal into markets which are now in the undisputed possession of other coal-producing centers. Outlets will be found North, South, East and West.

The anthracite coal combination has likewise established new outlets for that valuable fuel, and other schemes are under consideration for the further establishment of outlets which will create a much wider demand for that coal than exists at at this time.

Another syndicate has been formed of New York and Pittsburgh capitalists, for the control of the coke trade of the Connellsville region in Western Pennsylvania. There are now between 10,000 and 11,000 ovens, with from 2,000 to 3,000 in course of construction, or projection. Much of this valuable traffic is now enjoyed by the Pennsylvania Railroad Co. Vanderbilt's new road will tap this region, and it is expected that a traffic of 700 cars daily will be secured. The combination is made up of men who know the coke business thoroughly, and who will doubtless throw their capital and knowledge in such directions as will lead to the greatest possible development of that region. The demand for coke can be greatly increased. Its superior utility as a fuel is being more largely recognized, and the shipments are increasing both East and West. It is probably intended by this syndicate to control the production of coke to realize the highest possible profits, as well as to secure the largest possible trade, and to prevent the cutting of prices, which, within a very short time, has reduced the price from $1.75 to $0.90 per ton. The coke producers believe that with proper management prices can be held at about $1.25; this, they think, is not an exorbitant price, but a very reasonable one, and one which consumers are ready and willing to pay. And, in fact, they are more ready to pay this price than prices under $1, because of the uncertainties which are believed to surround the coke interests when the product will not command better prices.

A like tendency has been developed in the bituminous coal region of Pennsylvania, and nearly all the valuable tracts are now owned by syndicates, large and small, which will hold their possessions until such time as the market justifies their development. Several short lines, about a dozen in number, are now under construction in the mineral regions of Pennsylvania, which will bring new localities into market, and if the supply is not increased, the value of the land will have increased, and consumers will be assured of an abundant supply for years to come.

A line is under construction by the Baltimore & Ohio interests from a point near the southern border to the northern tier of counties crossing a most valuable section, and connecting with northern and southern railroads and with the lakes. These investments are very valuable ones.

It is not to be wondered at that investments are seeking this new channel, when the scarcity of good railway securities is considered. Money is abundant and cheap. Credit is sound, and large amounts of capital lie idle, waiting for even 4 per cent. Industrial enterprise is driving ahead. Demand for industrial capital is expanding. Dividends are large in most directions. This superabundance of capital can only find a safe outlet in this new direction. Increasing competition between railroad lines, the disposition to curb railroad corporations, and a number of lesser influences which the reader can easily bring to mind, all go to show why it is that money-lenders are more anxious to place their capital in channels where higher and safer dividends can some day be realized. The basis of all this is the increasing industrial activity in all parts of the United States. the decentralization, so to speak, or, more properly, the diversification of our industries. Land is in demand; the overcrowded millions here and abroad want more room; the railroads are opening boundless opportunities; capitalists are taking up desirable lands and are offering them with their facilities in the shape of improvements and betterments to the incoming tide.

Even in Texas, where the narrow-gauge system is opening up new territory, arrangements are being consummated by which the western narrow-gauge system will be connected with the eastern. In Wisconsin a network of railroads is being constructed which will bring within reach of market large areas of territory, valuable for ore, coal, grazing and wheat raising.

THE COLON SECTION OF THE PANAMA CANAL.

[Translated for Engineering News from Le Génie Civil.]

In any enterprise the means adopted should be in direct proportion to the importance of the work to be done. At Panama the problem is a gigantic one; hence the preparation for work to be accomplished will necessarily assume similar proportions.

The isthmus can supply but few of the needs of this great enterprise; all must come from Europe or the United States; and, this being the case, among the first requirements was a port of entry, with all its marine and industrial outfit, its docks and workshops. After this a city had to be built to contain the population which the work attracted to itself.

This preparatory work was commenced in January, 1881, and the point first selected on the Atlantic side was the harbor of Colon. This place had many advantages; it was the point of arrival of several lines of steamers from Europe and New York; it was the east end of the Panama Railroad, and most of the wharves were well-equipped for the transfer of material from ships to the railroad.

But on further consideration, the company recognized the fact that it could not count upon any of the six existing wharves for its service; they belonged to as many different lines of steamers, and the Panama R. R. wharf, wrecked by storms and the shock of vessels against it, was entirely out of service.

The company soon found itself much embarrassed in the handling of its material, having no especial place for unloading; and as the day of arrival and departure of the steamers was fixed in advance, all material had to be hastily unloaded from the Canal Companies boats, and as hastily removed from the wharf to make room for the new arrivals.

It was at first intended to buy and reconstruct the Panama R. R. wharf for the exclusive use of the company. But supposing this action would solve the question of handling the material, the problem yet remained of providing storehouses, workshops and homes for the employés; for the Island of Manzanillo, upon which is built the City of Colon, is, properly speaking, a mere swamp, in the interior of which it is impossible to erect any buildings.

The west coast is already occupied by a few farms, by the city, and by the railways and wharves; the north coast presents only a very narrow strip of land between the swamp and the sea. This last spot, however, is the best on the island, as it is exposed to the direct sea breeze; but room was wanting for the required constructions, which would necessarily cover a large space, and furthermore it was too far removed from the Panama R. R. wharf.

Some other point than the island of Manzanillo must evidently be selected for the use of the company.

We ought to here remark that Colon has always had an unpleasant reputation for its unhealthfulness. Without repeating all the stories told of this unhappy country, we are obliged to admit that a stay in this city is not agreeable. It is, in a word, the most sickly point on the Isthmus, and the chances of being stricken by disease are further enhanced by the gross ignorance and filthy habits of the colored natives. They seem to think that it is handy to have an open sewer before their doors, into which all manner of unclean things are daily thrown, to fester under a tropical sun.

M. Blanchet, failing to find a seaport, resolved to found a port on the River Chagres, as a solution of the problem presented. About six miles from Colon, following the line of the railroad, and about nine miles from the mouth of the Chagres, is the town of Gatun, which is surrounded by uplands sufficiently elevated to seemingly promise a healthy location.

One of these hills is situated upon the right bank of the Chagres River; the railroad passes at its foot alongside the river, and the canal will be located on the left bank and about a thousand feet from the Chagres.

Between the sea and Gatun, the Chagres is from 23 to 26 ft. deep; but a bar at the mouth of the river reduces this depth to about 13 ft. While the present water is sufficiently deep over the bar, for most of the vessels using it, a dredge can easily make and maintain a deeper channel when required.

Mr. Blanchet now gave the order to abandon the unhealthy and crowded port of Colon, and to create an entirely new port, with its docks and workshops, at Gatun; and put the houses of the men upon the top of the hill. This was the *Cité de Lesseps*; work was rapidly pushed, the top of the hill leveled off, and a sufficient number of buildings erected; at this place the first excavators were put together ready for work.

But unhappily the climate declared itself against this enterprise. The first officials sent to Gatun, not having as at Colon the advantages of hotels, at least habitable, were compelled to lodge either in the huts of the Indians, or in the unfinished barracks. The swamp fever broke out; some died, and the remainder, panic stricken, declared Gatun more unhealthy than Colon.

The scheme of an interior port was then condemned; fault-finders abounded; and this idea, conceived in a proper and humane spirit, was made a reproach to its author and looked upon as a gross blunder. This first mistake was the first step toward the grave of the unhappy Blanchet.

In abandoning Gatun, where the new city stood, sad and deserted, it was necessary to return to Colon. But if Colon, with its certain insalubrity, was preferred to the perhaps accidental state of affairs at Gatun, the necessity did not the less exist for founding an entirely independent port, and providing land for the required structures.

The entrance to the canal being fixed in the arm of the sea which separates the Island of Manzanillo from the mainland, it was decided by M. Hersent to fill in the marshy coast lying between the railroad and the southwest shore of the island; and even to reclaim a certain area from the sea, by pushing out into the Bay of Limon a mole destined to protect the future entrance port against the heavy gales and waves from north and northwest. This filled-in ground took the name of the *Terre-plein de Christophe Colombe*, and the entire force of this section was directed toward the speedy completion of this indispensable work.

Having finished the historical portion of our paper, we will now return to the question of the practical execution of the works of the company.

As the construction of the Terre-plein would consume much time, it was found necessary to buy or rent a number of small properties on the habitable portions of the island. In this way an establishment was founded on the northwest point

of the island, near the light-house, comprising the administration residency, the offices, barracks for workmen, a shed for the mounting of locomotives, a workshop and a saw-mill. Between wharves 4 and 5 (see plan) a slip was built for setting up the dredges and lighters; to the south of Wharf No. 6 was a slip for setting up the great floating crane of 40 tons capacity. The temporary storehouses were placed a little behind the south end of the town, and different houses in Colon were finally utilized for offices and lesser storehouses, etc.

All this was, of course, very inconvenient, and necessitated for the employés fatiguing journeys and much loss of time.

This period of provisional organization brings to mind some of the saddest memories connected with the history of the canal.

All who were present must recall the chief of service at Colon; laboring 16 hours per day; filling every rôle, even that of nurse, who, after exhausting his forces, succumbed to disease at the end of three months of his superhuman labor. This chief was M. Etienne (Antoine), an engineer well known, an old student of the *Ecole centrale*, and before entering that school, a workman to the age of thirty. It was difficult to find a successor, and his post remained a long time unfilled; then it was given to an engineer who remained but a short time on the Isthmus. A third was seized by the fever after a sojourn of two or three months. At last a fourth appeared—to whom we wish a sturdy and long resistance to climatic influences—and since August 1882 he has held the reins of this perilous government. From an administrative point of view, the organization of service at Colon has been somewhat modified. Originally Colon formed a general depot for the works, comprising the work properly so called, the workshops, material and the storehouses.

It was thought finally that this service was too complicated, and there were other objections and inconvenient features in leaving in the hands of a chief charged with the execution of the work at Colon, the care of the workshops and storehouses, and the furnishing of materials and all machinery needed on the other portions of the Isthmus. Evidently this chief ought to be free to provide first for the needs of his own works.

The general superintendency at Colon has now been suppressed, and the service has been reorganized under separate and distinct heads, or sections, including works, workshops and material, and general storehouses.

We will commence by giving for each of these sections a description of the labor required.

Of the general magazine we will have nothing to say except that the company is compelled to provide *all* necessary material, not only for the works but for the material life of its employés. The storehouses are amply furnished with food, furniture, bedding, and even laundries; all, in fact, that the laborers need to keep them in good condition on leaving the work. M. de Lesseps was opposed on principle to an organization which was certainly disastrous to local trade, but he has practically admitted the right of the men to have the opportunity of securing easily and in a cheap market all articles of prime necessity. The opinion of M. de Lesseps was inspired by proper notions of general equality and liberty, but on second thought it was better to endure the recriminations of the traders rather than the just complaints of the laborers who, exposing themselves each day, have a right at least to demand of the company a material existence as much as possible exempt from care. The running expenses of the general magazine amount each year to "several million francs."

The section devoted to the workshops and to material receives all the heavy material sent from Europe and the United States, which must be set up before it can be delivered to the different sections on the line of the canal. A few figures will show the importance of the work done by this department.

Of the 60 locomotives ordered in Europe, 27 have been sent to the Isthmus, and 20 have been set up and sent out to their proper sections since the commencement of 1883.

Of dirt-cars of 4, 5 and 8 cubic yards capacity, platform cars, carts, etc., about 2,000 have been ordered; of these 600 have been forwarded, and the greater number of these are in service. These cars are set up, some at Colon and some at Gatun, which is again becoming, as we foretold, a center of labor.

More than fifty excavators with endless chains or buckets (of the Couvreux or similar design) have been ordered; 18 have been sent to the Isthmus and are at work. Several American excavators of the "dipper" type have been ordered by the contractors, and some of them have arrived and are set up.

The dredging plant comprises four dredges of 60 horse-power each actually in service; these machines were completely mounted, even to the riveting of the hulls, at Colon.

The boats for carrying material, lighters and dump-scows, to the number of 64, sent from Europe, have all been put together or are in process of erection here, excepting two large steam lighters, built in Scotland by Mr. Lobintz, which traversed the Atlantic complete in all respects. These last mentioned boats are about 138 ft. long and 25 ft. beam. Each carried on the voyage two steam launches.

Mr. Lobintz has also sent from the same place, a marine dredge intended to work in the harbor of Colon. This dredge left Gareloch (Scotland) April 10 last, passed Madeira on 21st of same month, the Isle of St. Lucie (Antilles) May 6, and arrived at Colon May 16. Its principal dimensions are, length 171 ft., beam 26 ft., depth of hold 12 ft. The two engines, one to work the chain of buckets, the other the propeller, are 250 horse-power.

Mr. Lobintz is constructing a second dredge, similar to the one described, and destined for work at Panama. We wish a happy voyage to the brave sailors who will have to traverse the Straits of Magellan and double Cape Horn in this novel ocean steamer.

Of the two floating landing stages, one is in service, the other is being put together at Colon.

The naval outfit is completed by a flotilla of steamboats, launches for exploration, and tugs for towing, of 50 to 150 horse-power. Two of these last have traversed the Atlantic by their own power. All the rest have been set up here, excepting the small steam launches carried complete.

For the general shops and the works on the different sections, 34 stationary engines, all from the shops of Mr. Weyher, at Richmond (England), have been sent to the Isthmus.

We mention finally among the general plant, one floating crane of 40 tons lifting capacity, the hull of which was riveted and launched at Colon. This machine is actually in service.

One crane of 5 tons capacity, upon an iron hull, is also ready; and about 15 cranes of 2 to 6 tons capacity, worked by steam and by hand, are either mounted or are in process of erection at Colon.

As the work advances the repairs of machinery will become an important item. At present Colon is provided with only one small shop devoted to this service. The tools on hand will be soon insufficient for the work to be done. The company, foreseeing the necessity of an extensive shop for the mounting and repairing of machinery, had originally intended to found such an establishment at Colon.

But as the health of this city is not always reassuring, and as the sections which will require most of the material are near the middle of the Isthmus, they have decided to create three principal systems of shops instead of one. The first will be at Colon, the second and most important at Gorgona, near the middle of the Isthmus, and the third on the Pacific coast, near Paraiso. By this means they will avoid the transportation of material to too great a distance, and in case of an epidemic breaking out in one set of shops, two others will still be in service.

Coming to the works proper in the Colon section, they can be divided under three heads:

1. The building of the *Terre-plein de Christophe Colomb.*

2. The excavation at the port of entry to the canal.

3. The excavation of the canal itself from its entrance to a point near Gatun, at Sta. Kilometer 9.

The next section has started shops at Bahio, Soldado, at Sta. Kilometer 20. The limits of the two sections will be fixed at some future time between the last point and Gatun.

The Terre-plein.—The construction of this work will require about 470,000 cubic yards of filling material. It would certainly have been more advantageous to have used in this portion of the work the material excavated from the canal or its entrance. But, especially nearest to Colon, this excavation would have been in mud, containing living madrepores or corals, and these spread over a large surface and exposed to the sun's rays would certainly have had a bad effect on the health of the workmen.

And further, the dredging plant was less advanced than the dry-excavating plant. The first thing to do was to find a soil sufficiently dry and compact, and easy to excavate; this condition of affairs was discovered at the small Mindi hills on the line of the railroad, and about 4,000 ft. from the Island of Manzanillo. These hills rise to a height of about 50 ft. above the level of the sea, and are composed of a compact clay with some decomposed tufa.

The first excavators fitted up were put to work on these hills, attacking them at the base, on the level of the railroad. The material being very compact, it took a very steep slope, even overhanging sometimes. In this way the breaking off of the upper part would frequently catch the buckets and overstrain the driving drums, causing breakages. To prevent these accidents, workmen were stationed to throw down the earth a little at a time without waiting for it to break off of its own weight.

At the commencement of 1883 the plant at Monkey Hill included two Couvreux excavators, two American excavators and several picking machines. All of this machinery was not at work at one time. The American machines, among others, have proven that they are not capable of regular and continuous work.

But this material had to be transported as well as dug out. To use the Panama R. R. was to be at the mercy of a company which would always find some obstacle to retard the movement of the earth trains. So in June, 1882, it was decided to build a second way alongside the one existing already. Thanks to this special line, the work at Monkey Hill has been carried forward with all desirable activity; and up to the commencement of 1883 20,000 to 25,000 cubic yards have been each month carried to the *Terre-plein.*

The exterior contour of the *Terre-plein* being exposed to the action of the waves, is protected by rip-rapping; to procure the necessary stone a quarry has been opened on the west side of the Bay of Limon, at Kenny's Bluff. The working of this quarry was for some time in the hands of several American sub-contractors, but it became necessary to cancel these contracts, the parties failing to meet their obligations. The same thing was attempted at Monkey Hill, but did not result in good. It is desirable that the canal company, taught wisdom by a series of similar disappointments, should end by recognizing the fact that they can with safety depend only upon the co-operation of its European employés, generally capable, devoted and carefully chosen, rather than upon strangers of whom it knows neither the aptitude, good will or antecedents.

Kenny's Bluff under the company's direction sends each month about 1,600 cu. yds. of large stone blocks to the *Terre-plein.* This is a small amount, but the difficulty of loading and transportation must be taken into account. The American contractors did not handle half this amount.

Having now seen where and how e material

necessary for the construction of the *Terre-plein* is obtained, we will now describe the work itself.

The filling is almost completed, it covers an area of 74 acres reclaimed from a very low marshy soil, and from water almost 27 ft. deep.

At the N. W. end the *Terre-plein* extends 660 ft. in length and has a mean width of 393 ft., forming a vast mole. The line of quay proper for the landing of ships, and which shelters this mole, is 3,070 ft. long, or rather will be when the necessary dredging is finished. At present there is upon the inside of the mole a wharf upon wooden piles, measuring 445½ ft. along the sea front, which is reached by depths of water of from 16 to 26 ft.; its width is 41¼ ft. This will be finally entirely covered to protect goods just landed.

This wharf is made up of 270 piles in 54 bents of 5 piles each; the bents are about 10 ft. apart; the piles in each bent are a little more than 8 ft. apart. The piles are driven to a solid bottom in a bank of coral; they are shod, and covered with sheets of copper to protect them from the teredo.

The railways used in the filling process occupy the position they will finally have in tying together the different establishments with the Panama Railroad.

The houses of the employés will be on the outer line of the *Terre-plein* facing the sea; they are in two rows, forming a street called *Charles de Lesseps*, in honor of the voyage made by the son of the president of the company to the Isthmus.

These houses are of three types, intended for one, two or four employés. The smallest have two rooms, a kitchen and verandah, with the entire ground floor raised somewhat. The second type is really formed of two abutting houses of the first kind; the third is like No. 2, with the addition of a second story. The living rooms are 10×13 ft. in all cases, the kitchen is 10×8 ft.

We might here add that the Panama Wharf (No. 5) has been bought and repaired, and being now united by a special track to the *Terre-plein*, forms an important annex.

Dredging of the Port.—The present purpose of this dredging is to allow ships to approach the side of the *Terre-plein*, and to open up a passage for the transport of the material, etc., needed in digging the canal.

So far the dredging has been delayed by frequent boisterous seas in the waters to be deepened, and before the construction of the mole there was no shelter in case of bad weather. The marine dredges, of which we made mention before, will render good service, on account of their dimensions, shape of hull, and above all, the facility with which they can move themselves by their propellers, riding the waves or seeking shelter when the seas become too heavy.

But in the absence of these machines, taking advantage of calm weather and the shelter of the mole measured by the rate of its advancement, the dredges mounted at Colon have been utilized. Two of these have been pretty regularly at work, each moving from 1,100 to 1,300 cu. yds. per day. The coral reefs have several times arrested work; when one of these is met with charges of dynamite are exploded upon the surface, which disintegrates the mass sufficiently for the dredges to remove the débris.

The map shows the area dredged out at the end of February, 1883; the depth attained is 16½ ft.

The dredges are now deepening that part of Folks River lying against the railroad jetty. This will be an excellent harbor for all the naval outfit, and slips for repairs will be located upon the corresponding bank of the *Terre-plein*.

Digging of the Canal.—At the point where the company's dredges stop work commences the canal proper. From this point to Gatun the excavation has been let by contract to Huerne, Slaven & Co., of San Francisco, Cal. The principal clauses of their contract are as follows:

The contractors are to furnish all their own *materiel*; to commence work in August, 1882, and to be in full working order three months thereafter, that is to say, to handle in December 12,000 cubic yards of material per day.

The digging is to progress in three successive stages, the first cut to be 82½ ft. wide at the water surface and 8 7/8 ft. deep, to assure speedy communication with Gatun. The second excavation will make the depth of water 15 ft.; the third will reach the final depth of 28 ft. and the completed width of 165 ft. at water level.

These three stages of excavation to be finished as follows: The first one year from the day fixed for the commencement of the work; the others 2½ years after this same day.

The price paid per *cubic meter* (1⅓ cu. yds.) dredged, up to 6,000,000 *cubic meters*, is *one franc fifty centimes* (30 cents). For all dredging exceeding the quantity above named the price per *cubic meter* is reduced to 1¼ francs (25 cents). In case the ground should require the use of powder, special contracts will be made for such excavations. To judge of the manner in which Messrs. Huerne & Slaven will execute the work undertaken by them, it will be necessary to wait and see them at work.

We are obliged to admit that at present they seem to attach little importance to several clauses of their contract. In fact, the first dredge, which ought to have been at work in August, 1882, only arrived in Colon in April, 1883. The contract period of active work commenced in December last, when three dredges should have been in operation, handling 12,000 cu. yds. of material per day; as yet, not an actual hour's work has been done.

Will the promises made for the completion of each of the successive stages of the contract be better kept? We doubt it, especially in view of the fact that the first cut was to be finished in August next.

The American journals have given certain dimensions to these dredges which do not seem to accord with the work to be done. The Huerne dredges, which are of the endless chain type, are 100 ft. long, 60 ft. wide, and 12 ft. depth of hold. They have to dig a canal in solid ground, and in consequence must open a way large enough to enable them to swing from side to side without touching, with the angles of the hull, either slope. The first trench to be dug will be 82½ ft. wide at the water surface, and will have a bottom width of only 56 ft., that is 4 ft. less than the width of the hull of the dredger. The dredge will thus find itself, so to say, boxed up in the ditch, without being able to execute the swinging movements necessary to advance the digging.

It is true that the contractors, in constructing machines capable of digging out the canal to its full width in one operation will not be compelled to work in a ditch where the circulation of the company's material would always be troublesome to them.

To finish our description of the Colon section we must now go to Gatun, where a company's dredge arrived in April, 1883, by way of the Chagres. This is now at work on a cut destined to divert the waters of the Chagres to the west of the Indian village and the canal. This done, floods will no longer effect the trench of the canal; and later, when the waters of the Chagres itself will have been thrown back toward the other bank—that is to say, on the side of the railroad—this new channel will catch all the streams flowing in on the left bank.

PERSONAL.

J. J. R. CROES, Mem. A. S. C. E., Mem. Inst. C. E., has been engaged to prepare plans for the sewerage of East Orange, N. J.

MR. C. HARRIS, for several years Chief Engineer and General Superintendent of the Chicago & West Michigan, has resigned his position.

FREDERICK T. STANLEY, one of the oldest and most prominent citizens of New Britain, Conn., died Thursday morning at the age of 81 years. He was the originator of the lock-making business for which New Britain is famous. He was founder of the Stanley works, designer of the waterworks and first Mayor of the city.

COL. O. M. POE, Corps of Engineers, at present on duty at the War Department, Aide-de-Camp to Gen. SHERMAN, is ordered to succeed the late Major FRANCIS M. FARQUHAR, in charge of the harbor improvements at Detroit. Col. POE will however continue to serve, in addition to his new duties, on the staff of the General of the Army until the retirement of Gen. SHERMAN.

COL. J. H. BRITTON has accepted the position of State Engineer for Texas, and begins his duties Aug. 1. The law demands that the Engineer shall not be in any way interested in any railway, and Col. BRITTON'S delay in accepting the position was due to the fact that he was engaged in trying to effect a release from railroad contracts and obligations entered into prior to his appointment. Col. BRITTON has not yet selected his subordinates.

CAPTAIN JOHN ERICSSON, the inventor, reached his 80th year on Tuesday the 31st, ult. He was born in Langbaushytten, in the province of Wermeland, Sweden. His father was OLAF ERICSSON, a mining proprietor. He lives in a plain, unassuming building at No. 36 Beach street, this city, and though at an age when most men are feeble and in their dotage, he seems to have renewed his youth, and his mind is as clear as ever. At present he is busy with his great solar engine and his boat Destroyer. When Mr. ERICSSON was thirteen years old he was put in charge of a section of a ship canal which was being surveyed by the corps of engineers in which, through the influence of Admiral Count PLATEN, he had obtained an appointment as cadet. From being an engineer on the Gotha Canal young ERICSSON became an officer in the Swedish Army, and hence his title of captain. In 1826 he visited England on leave of absence and never returned to his native country. In 1829 he entered his locomotive Novelty in the competition which was won by GEORGE STEPHENSON'S celebrated Rocket, though ERICSSON'S locomotive attained a much greater speed than STEPHENSON'S. In 1833 he first brought to public notice his caloric engine. In 1837 he constructed the first practicable propeller vessel, the Francis B. Ogden, and the disfavor with which this was received by the British Admiralty resulted in Captain ERICSSON'S departure for America in 1839. His record in America began with his first essay in war ship building, the Princeton, which was the first steamship ever built with machinery protected from shot by being placed below the waterline.

Comptroller CAMPBELL of this city, sent his resignation of office to Mayor EDSON on Friday of last week. The reasons therefor are given in the letter as follows:

CITY OF NEW YORK, FINANCE DEPARTMENT, COMPTROLLER'S OFFICE, July 26, 1883.

The Hon. Franklin Edson, Mayor.

DEAR SIR: As you know, I have been seriously ill for a long time past. I am advised by my attending and consulting physicians that absolute rest, immediate, and for a period longer than I could possibly spare from the confining duties of my office, is my only chance for permanent restoration to health.

Under these circumstances I have, with great reluctance, concluded to resign my office, and hereby tender you my resignation of the office of Comptroller of the city of New York, to take effect on the 1st day of August, 1883.

My regret at being compelled by illness to take this action is the more poignant in view of the important additional duties devolved on the department at the last session of the Legislature, in the discharge of which I would gladly have done my share, and also in view of the wrongs recently discovered in the department, the full and complete investigation of which I was and am most anxious to aid.

Absolute physical prostration is, however, an impediment with which it is us less to contend, and by it, and it alone, I am compelled to give up a work which I had hoped to do to the satisfaction of my friends, the public, and my co-officials in the city government. Yours respectfully,

ALLAN CAMPBELL, Comptroller.

The N. Y. *Sun* says editorially: "We think it is a public misfortune that Mr. CAMPBELL has found it necessary to resign on account of bad health. We suppose that the original cause of his illness is mortification at the coupon frauds. To a man of sensitive constitution and high moral ambition, like Mr. CAMPBELL, nothing worse could happen than to find that such frauds had taken place in his own office and under the shield of his character and authority. A man of a duller and less exalted nature might take such an event composedly, but Mr. CAMPBELL felt it as a blow at his honor.

"We say the resignation is a public misfortune, because it is not likely that we shall obtain another Comptroller of such genuine quality or such elevated motives. There is nothing base about him. He is a gentleman through and through."

NEWS OF THE WEEK.

A CORPS OF SURVEYORS will soon be at work on the proposed line between Belleville and Centralia (Ill.).

NEW ROADS IN OHIO.—Mr. Manning, the engineer of the Central Ohio, has begun a survey to locate the line from Bellaire to Bridgeport. The Central Ohio and the Tuscarawas Valley roads are to be united and further extensions made.

HEAVY DAMAGES ON AN IRON CONTRACT.—Rhodes & Bradley, of Chicago, obtained a judgment for $82,422, in the U. S. District Court, against the Cleveland Rolling Mill Company, Ia. In 1879 the Cleveland mill made a contract with the suitors for the delivery of 8,000 tons of pig iron during the next year at $45 per ton. There had been 3,421 tons delivered, when, in March, 1880, notice was served on Rhodes & Bradley that no more iron would be accepted at that price. The difference between the contract price, $45, and market price, $27, formed the item of the bill. There is to be a new trial.

BRIDGE OVER THE SOUTH SASKATCHEWAN.—Tenders are now being asked by the North American Construction Company for the permanent substructure of the C. P. railway bridge over the South Saskatchewan at Medicine Hat. The piers are to be of solid masonry, and the superstructure of steel. The latter is about completed and ready for delivery the moment the mason work is ready to receive it. The entire length of the bridge is 2,109 ft., of which 1,012 ft. is over the stream proper, the remainder covering the approaches. There will be 3,200 yards of masonry in the substructure. There are three spans of 217 ft. each, one of 149 ft. 7 in., and another of 148 ft. 7 in. The pier for the swing to turn on is to be a massive affair. The bridge is 40 ft. above low water level.

MAJOR ALCOTT, Civil Engineer of the New York, Texas & Mexico road, was lately in Houston, Texas. He says that a surveying party is in the field. If the road is built, it will enter Houston from the west and above the head of navigation, so as to avoid the expense of a drawbridge.

THE SURVEYORS of the Cresson, Clearfield & New York Road, have got as far as Jerona, Clearfield Co. (Pa.).

IRON BRIDGE MATERIAL has been bought recently in Pennsylvania by the Mexican Central Railway Company. Formerly such purchases were made in Europe, but it is now seen that American bridges are as strong as the English, far lighter and can be obtained cheaper and more readily.

BRIDGE CONTRACT.—John LeMay, of Duluth, has been awarded the contract for building bridges on the eastern extension of the Canadian Pacific Railway, and will begin operations at once. The work under contract will require 250,000 feet of timber.

BUYING UP COKE OVENS.—PITTSBURGH, July 30.—A syndicate with practically unlimited funds has been formed for the purpose of obtaining control of all the coke-producing ovens in the Connellsville region. H. C. Frick, Thos. Carnegie, Thos. Mellon, David Hostetter, and D. A. Stewart, of Pittsburgh; W. K. Vanderbilt, of New York, and other Eastern capitalists identified with the Vanderbilt-Gowen interests, are mentioned as in control. Their object is to remove the competition now demoralizing prices, and to furnish business for Vanderbilt's proposed road from Pittsburgh to the coke regions. The syndicate also intend to bridge the Youghiogheny River at Bradford, and build a branch to Mt. Pleasant, to obtain the product—about 700 cars a day—of this region. The charter for the branch road has already been secured, and options obtained on at least half the ovens in the coke region; among these are 1,200 ovens owned by A. A. Hutchinson & Co., for which $800,000 is asked; H. C. Frick, of the syndicate, already owns 2,000 ovens. They expect to be in complete possession of this great industry within the next sixty days.

RAILROAD BUILDING IN IOWA is peculiar. A contemplated road, before it is completed, usually passes under several titles, or becomes identified with several others. It starts with a title; soon after a syndicate is formed, the company is reorganized under another title, the new company forms a construction company with another title, which builds the road, takes the bonds, gets the money, and sells out to themselves under another title. Here we have the Chicago, Burlington & Pacific Construction Company building the Central Iowa from Oscaloosa to Council Bluffs, from Newton to Sioux City, and from Keithsburg east to Lacon, Ill., and west to Oscaloosa. It now transpires that Alfred Sully, who has been furnishing the money, is getting short, and has held up until he can form a syndicate with capital sufficient to carry the work to completion. It has been stated the Indiana, Bloomington & Western were also backing it, probably not directly, but Sully and other capitalists of the Indianapolis, Bloomington & Western are also large owners in the Central Iowa—it is understood have a controlling interest.

THE WISCONSIN CENTRAL is to be extended from Chippewa Falls to St. Paul.

THE Ohio Valley Cement Co. has secured a contract to furnish 150,000 barrels of cement for the new State-house at Austin, Tex.

THE contract for building the Muskingum River Railroad, from Zanesville to McConnellsville, has been given to Messrs. Coolman & Paige. The road must be completed within one year.

BREACH OF CONTRACT.—G. M. Strader, of St. Paul, Minn., has begun a suit against the Northern Pacific. The complainant alleges that in 1882 he made a contract with the company to sell them 1,000,000 brick at $11.50 per thousand, the brick to be delivered at Miles City, Montana. The company only accepted 160,000 brick.

NEVADA (KAN.) WANTS WATER-WORKS.—Mr. Crosby has surveyed the ground to the Marmaton River, and plans will soon be laid before the people.

THE BRIDGE OF THE JACKSONVILLE, TAMPA & KEY WEST RAILWAY, between St. Johns and Palatka, on McGirt's Creek, will soon be finished. Col. Carter, the engineer, inspects the bridge in a small steam yacht. It will be 1,240 ft. in length. Two other bridges are being built on the road.

OSHKOSH WATER-WORKS.—The entire system of iron piping for the above new water-works will be made by the Cincinnati & Newport Iron and Pipe Company.

SEVERAL LARGE RAILWAY BRIDGES have been carried away by the breaking of the jam of logs in the West. At Grand Rapids (Mich.) the bridge of the Detroit & Grand Haven Railroad was carried away, and also that of the Grand Rapids, Indiana & Chicago.

WELLINGTON (Kansas) is to have water-works. The work will be begun without delay.

THE SURVEYS for the Grand Rapids & Spiritwood (Dakota) road have been begun.

KANSAS CITY IMPROVEMENTS.—There are more improvements going on in Kansas City than ever before, says City Engineer Knight. There are four new sewers in process of construction, three are about ready to begin, and preparations for seven or eight others are being made. There are fifteen contracts for street grading now out, and in the matter of paving, four streets are under contract—Third and Fourth with wooden blocks; a portion of Delaware with stone, and Walnut from Twelfth to Twentieth with improved macadam. Petitions for paving Main street and Fourteenth are in circulation, and contracts for this work will probably soon be let. Then a large amount of work in the way of curbing, guttering and laying sidewalks is under way. There was more money expended last year on public improvements in Kansas City than in Cincinnati, and yet Cincinnati has 200,000 more people than Kansas City, and moreover lacks nearly as much of being a finished city as this place does. Last year public improvements in the Ohio metropolis cost $274,000, while in Kansas City $286,000 was expended, which shows a sum in favor of Kansas City amounting to $12,000. The engineering expenses in Kansas City were, moreover, only 4.8 per cent. of the expenditures, while in Cincinnati they amounted to 10 per cent. Our sewers cost $10,000 more than Cincinnati's, that city laying 3¾ miles, while Kansas City laid 5½ miles.

THE HENNEPIN CANAL.—The Hon. J. H. Murphy, of Iowa, was recently in Washington in the interest of the canal scheme. He examined the engineer's report, which is very voluminous. The engineer's report on the Hennepin Canal presents three routes, known respectively as the Meredocia, Watertown and Rock Island routes. Mr. Murphy says the Meredocia route is the cheapest, but in many respects is objectionable. It is not on the line of commerce, and would be impracticable from the fact that overflows could not be prevented. In addition to this, the commerce of the South would be forced to go up the rapids about forty miles, and this would make rail transportation cheaper. The Watertown route is better, but the same objections apply to part of it. The Rock Island route is, however, in Mr. Murphy's opinion, the best route. It was the one originally contemplated. The Meredocia route strikes the Mississippi about forty miles north of Rock Island, the Watertown route strikes it about seven miles above, and the Rock Island strikes it just below Rock Island, at the mouth of Rock River.

PROPOSED R. R. FROM ST. LOUIS TO KANSAS CITY.—St. Louis papers announce the purchase by Vanderbilt of the St. Louis & Central Missouri and the Hogan Belt roads. This is thought to mean a new road to the Missouri River. It is also rumored that Mr. Garrett, of the B. & O., has announced his intention of shortly taking entire charge of the Ohio & Mississippi R. R.; and that the company will then be compelled to build a connection with the Santa Fe and other roads out of Kansas City. For the present they would use the St. Louis bridge, but he thought that eventually the Chicago & Alton, the Vanderbilt and the Pennsylvania lines would be compelled to erect a new bridge independent of the Gould interests.

A ROYAL AGRICULTURAL SHOW is now in progress at Knavesmire (England). The exhibition covers 80 acres and there are 6,058 exhibits. Traction, stationary and portable engines, agricultural locomotives, wagons, carts and all manner of agricultural machines abound.

SURVEYS ARE MAKING for the Gulf, North Louisiana & Kansas City Narrow-Gauge Railroad. Mr. John Merrill is the engineer in charge.

AN AERIAL NAVIGATION COMPANY, with a captal of 2,000,000, has been incorporated in Chicago.

A NEW USE FOR CEMENT.—At the recent gathering of cement manufacturers in Berlin, Dr. Fruhling described a new application of cement to burial purposes. He suggested the use of coffins of a rectangular shape, the body to be completely enveloped in Portland cement, which he claims will harden without in any way indicating the organic changes going on within. A stone mummy is the result, and among the advantages advanced by the doctor were the securing of an accurate cast of the features, which could be reproduced after the lapse of centuries; and furthermore, as the coffins soon become masses of stone, underground sepulture was needless; the coffins could be built into pyramids.

BARGES AT LOUISVILLE, KY.—The following bids were received and opened May 25, 1883, for furnishing two 80-ft. barges, to be delivered at Louisville, Ky., Aug. 1:

John Wesley Cook, Allegheny, Pa., $1,050 each.
Howard & Co., Jeffersonville, Ind., $1,050 each.
John Young, Mason City, W. Va., $1,085 each.
Covington Dock Co., Covington, Ky., $1,147 50 each.
J. E. Thayer, Charleston, W. Va., $1,175 each.

The contract was awarded to John Wesley Cook, of Allegheny, Pa.

PAINTING AND POLISHING FOR CUSTOM-HOUSE AT ST. LOUIS, MO.—The following is a synopsis of bids for painting and polishing for the custom-house and post-office at St. Louis, Mo., opened July 27, 1883:

Flesh & Mook, $4,463.65.
George & John Pelsch, $4,700.
Hunt C. Wilson & Alex. Yule, $5,484.74.
McGinness & Cornelius, $6,473.
John Gibson, $8,749.
John W. Carr, $11,650.
George A Mills, $11,985.

The bid of Flesh & Mook, the lowest, has been accepted.

IRON BEAMS, ETC., FOR POST-OFFICE AT JACKSON, MISS.—The following is a synopsis of bids for iron beams, columns, etc., for the court-house, post-office, etc., at Jackson, Miss., opened July 27, 1883:

Asa Snyder & Co., $3,598.13.
Merz Architectural Iron Works, $3,780.64.
Phœnix Iron Co., $4,010.99.
M. Clements, $4,042.26.
Snead & Co., Iron Works, $4,093.77.
Haugh, Ketcham & Co., $4,325.50.

The bid of Asa Snyder & Co., the lowest, has been accepted.

CINCINNATI BUILDERS BUSY.—CINCINNATI, Aug. 1.—The President of the Builders' Exchange, Elwood Cuezy, says he has never known builders to be so pressed with work as now. The activity began immediately after the February flood, being caused so early in the season by the necessity of repairing injured buildings and replacing those which were washed away. By the time that work was done the regular building season opened. The number of new buildings proposed to be erected has exceeded the ability of the trade to erect. There have been no troublesome strikes, and contractors and mechanics are having the most profitable summer which they remember.

THE LARGEST GAS MAIN.—What is said to be the largest gas main in Europe, if not in the world, is now being laid down from Charing Cross to Pall Mall, and in other places in London. The diameter is four feet, the largest main previously laid in London having not exceeded a diameter of three feet. Over twenty-three miles of this four-foot main, in four diverging lines, are said to have already been laid from the great gas-works at Beckton-by-Woolwich, the work having been begun ten years ago.

RAILROAD BUILDING IN CALIFORNIA.—Statistics of railroad construction for the first six months of the current year show that California leads all the other States and the Territories in the number of miles constructed. This was owing to the building of the California extension of the Atlantic & Pacific, which comprises most of the new mileage in this State, but considerable progress has been made on other roads. The San Luis Obispo and Santa Barbara narrow gauge is completed to Los Alamos, a distance of sixty-five miles, and it is to be finished to Santa Barbara before the end of next year. On the California & Oregon Railroad work is still being pushed, though it has been

found necessary to abandon the original surveys and discover some route that will not follow the benches on the river bank, which cannot be utilized because they are subject to overflow in the rainy season. A surveying party is at work on the proposed road from Oroville into Plumas County. In Arizona work has been commenced, with a small force, upon a proposed narrow-gauge line from Tucson to connect with the Atlantic and Pacific.—*San Francisco Alta, July* 23.

HARBOR AND RIVER IMPROVEMENTS IN THE CAROLINAS AND VIRGINIAS.—Capt Mercur, Corps of Engineers, has submitted to General Wright his annual report of operations in that district during the last fiscal year. From the report it appears that improvements were made of the harbors at Norfolk and its approaches, Archers, Hope River, Va.; Blackwater River, Va.; North Landing River, Va., and N. C., Meherrin River, N. C.; Currituck Sound, Coanjack Bay and North River bar, N. C.; Pamlico and Tar rivers, N. C.; Beaufort Harbor, N. C.; Neuse River, N. C.; Trent River, N. C.; New River, N. C.; Contentnea Creek, N. C.; Cape Fear River, N. C.; Lillington River, N. C.; Town Creek, N. C.; Yadkin River, N. C.; Waccamaw River, S. C., Great Pee Dee River, S. C.; Santee River, S. C.; and Wateree River, S. C.

A BRIDGE ACROSS BARNEGAT BAY.—The Pennsylvania Railroad Company has contracted for the construction of a bridge across Barnegat Bay.

THE MARINE AND MECHANICAL ENGINEERING and metal trades exhibition, held in London during the first three weeks of this month, was one of the remarkable specialty expositions of the year. The exhibitors, numbering about five hundred included many of the great engineering firms of Great Britain. Casting, forging, tramway, bridge, and girder work, and the various tools used in the manufacturing processes, were among the exhibits. In a statement of the importance of these industries it was noted that the iron and steel exports of Great Britain last year amounted in value to $215,000,000, beside the vast home demand for railing and other interest and for machinery.

THE TAHANTO COTTON MILL.—This is a new enterprise, backed by heavy business men of Providence, R. I. Capital, $300,000. To be located at Fisherville, N. H. Plans are already drawn.

CHICAGO, IOWA & KANSAS R. R.—Charter filed at Topeka, Kan., on the 30th ult. The line is from Odell, Gage Co., Neb., to Salina, on the U. P. R. R. W. W. Guthrie, Thomas J. White, George F. Bowen, Atchison; I. M. Marquett, J. D. Macfarland, T. E. Calvert, Lincoln, Neb.; G. W. Holdridge and J. G. Taylor, Omaha, are named as the directors.

ST. LOUIS, EMPORIA & WESTERN R. R.—From St. Louis, Mo., to Emporia, Kan., by way of Rich Hill. The incorporators are Daniel Hay, of Nashville, Ill.; Jacob Smith, of Topeka, Kan.; J. E. Culver, Geo. Frederick and J. E. Lambert, of Emporia, Kan.

THE MISSISSIPPI RIVER IMPROVEMENTS.—John Evens, U. S. Civil Engineer, in the new government steamer Patrol, is about commencing a complete inspection of the river from St. Louis to New Orleans. Water-gauges are to be established at Rush Tower and Gray's Point and other gauges now in use continued. Low water sectional soundings are to be made on all sand-bar and shoal crossings, and greatest depth of water ascertained. Levels will be taken from St. Louis to New Orleans, and special surveys made at Morganza and Bonnet Carre crevasses.

THE FLORIDA SHIP CANAL. Gen. Chas. P. Stone, Chief Engineer of the project, has been interviewed by a Florida reporter, with the following result: The field work is finished. Mr. A. F. Hill, his assistant, had had four corps of engineers in the field for "nearly a month past." The General regards the project feasible from an engineering stand-point; the water divide is short and steep; he thinks it would pay financially, as it would shorten the passage in and out of the Gulf from three to seven days, and avoid the dangers of navigation through the Florida Straits. As to the non-existence of harbors at either end, he says he can make them. The estimate of cost and general data is promised in his August report to the directors.

WATER AND GAS AT QUINCY, ILL.—After months of darkness, the Council, by the necessary two-thirds majority, has ordered levied a 2½-mill tax to supply water, gas and electric light. A contract at $20 per lamp per annum was made with the gas company. A satisfactory contract has been made with the water company. The limit of taxation of $1.03 on the hundred for general purposes outside of the water and gas will be sufficient, and enable the Board of Public Works to keep the streets in good repair.

FAST TUNNEL DRIVING.—The 2,200 foot tunnel for the Delaware, Lackawanna & Western Railroad, at Factoryville, Pa., is being rapidly pushed forward and will soon be completed. The tunnel is 16 feet wide by 20 feet high and is being driven from both ends through hard rock. Work was commenced Dec. 10, 1882, and the headings 7×16 feet independent of breakage were driven through May 26, 1883, in five months and ten days working two faces. This, the contractors, Dowling & Kennedy, claim beats any previous work by 200 feet. The greatest distance driven in one month was 502 feet, which is undoubtedly fast driving. The machinery employed consists of six 3-inch Ingersoll drills, four in the headings and two on the benches, which are supplied with air by an Ingersoll compressor of the most approved type (diameter of steam and air cylinder 16×24), which in turn is supplied with steam by three of Southers' 20 horse-power vertical boilers. An equal pressure of steam and air is carried of from 70 to 80 lbs., cutting off steam in compressor at about one-half stroke.

NEW GAS-WORKS.—Lindsay, Ontario, is to have a gas works. The Lowe system is to be employed, and the work of erection was begun in June.

BOONE WATER-WORKS AND SEWERAGE.—Boone, Iowa, will employ an expert to plan a system of sewerage and water-works.

PIPE CONTRACT LET.—A contract for 10,000 lengths of 4-in. pipe was lately awarded to A. H. McNeal, of Burlington, N. J., by the Philadelphia Gas Trust officials.

CONTRACT AWARD.—The Board of Control of the Institute for the Blind at Lansing, Mich., awarded the contract for building the two new wings provided for by the last Legislature to Farr & Vincent, of Grand Rapids; price, $57,856. There were five bids in all.

THE EFFECT OF BAD WATER.—NEWBURG, N. Y., Aug. 2.—There have been over twenty cases of serious illness and two deaths on High street, in this city, caused by drinking water from a well contaminated by sewage. Five families had three cases each. In one instance four persons were ill in one house. The illness was enteric fever of a typhoid form. An analysis showed that the water contained chlorine. The use of the well has been stopped.

LYNN, MASS., WATER SUPPLY.—Surveys are to commence at once.

SEWERAGE.—Oneonta, N. Y., trustees are debating the question of sewers.

NEW YORK CITY CONTRACTS.—Contracts for sewer work; street grading and paving; receiving basins; setting curb stones, etc., will be let on the 9th inst. For particulars see *City Record* of the 2d inst.

NEW VERMONT RAILROAD.—There is talk of a new railroad line from Rutland west to Granville, N. Y., and thence to connect with the Greenwich & Johnson Railroad at Greenwich, to be built by some of the slate men in the western part of Rutland County.

A TUNNEL is to be cut by the Reading Railroad through Broad Mountain (Pa). It will be three miles long.

A BRIDGE over the Schuykill near Limerick Station (Pa.), is projected.

THE ST. LOUIS WATER FAMINE.—St. Louis was in much alarm last week on account of the scarcity of water. Sprinkling the streets was stopped. The evil seems, however, to be only temporary.

RAILROAD WORK.—Work on the new railroad from Webster to a point on the Boston & Albany Railroad about seven miles west of Worcester, is now progressing rapidly, and it is expected to have the line opened for business by October 1. It is ten miles in length, and is being built by the Providence, Webster & Springfield Railroad Company.

PROPOSED NARROW GAUGE LINE.—An enthusiastic railroad meeting was held in the Opera-House at Lockport, N. Y., July 31, under the auspices of the New Lockport Improvement Association for furthering the building of a narrow gauge railroad between Lockport and Olcutt Harbor, with prospects of a future extension to Akron, to connect with the West Shore. Stirring addresses were made by John Hodge, Hon. Burt Van Horn, Col. McRea and others. Committees were appointed to raise money and take charge of the survey.

CONTRACT LET.—Cyrus Frisbee, of Hot Springs, was the lowest bidder for the construction of the Army and Navy Hospital at that place, his bid being $86,385. The highest bid was $150,000. It is the impression of government officials that no bid should have been lower than $100,000.

EVANSVILLE, WASHINGTON & BRAZIL. — VINCENNES, IND., July 31.—Preparations are being rapidly made for the early completion of this line of road.

DENVER & RIO GRANDE RAILROAD.—The contractors on the Garfield branch of the Denver & Rio Grande are pushing the work with all speed. They have commenced distributing the ties from Maysville and have a heavy force of men on the switch back here. Monday evening last, in a lime cut just below town, they discharged one blast of twenty-five kegs of powder, doing heavy execution, shaking the buildings in town, but doing no damage. The numerous blasts in the evening, with the accompanying echoes in the cannons, sound like a battle.

HOLYOKE CONTRACTS.—It is expected that the city will set at least 12,000 feet of curbing the present season, 9,000 feet having already been set. This is a much larger amount than usual and some parties who have applied for it have been refused. A few years ago nearly 12,000 feet were set, but since then from 5,000 to 8,000 feet have been the usual amount. The stone received this year has been of excellent quality, good lengths and a fine color.

ELECTRIC LIGHT PATENTS.—The patent interference case of N. S. Keith, of the American Electric Storage Company, of New York, against Charles F. Brush, of the Brush Electric Light Company, of Cleveland, Ohio, was decided on Thursday, priority of invention being awarded to Brush. The declaration in the case contained three counts, each supposed to represent a distinct invention claimed by both as follows: First, a secondary battery having a plate of cast-lead supporting the active coating; second, a secondary battery element consisting primarily of cast-lead; a method or process of making a secondary battery element, consisting in casting a suitable body, frame or other support of lead, and placing thereon an active or absorbing coating or substance.

SPRINGFIELD (MASS) PIPE LAYING.—The largest piece of work done this year by the water department was the laying of 2,100 feet of 12-inch pipe on Main street, with 14 fire hydrants. On South street from Mill River to Long Hill have been laid 700 feet of 12-inch pipe, with two hydrants; on Long Hill street 2,500 feet of eight-inch pipe, with four hydrants; on Chestnut street, from Worthington to Franklin, 1,900 feet of eight-inch pipe and eight fire hydrants; on Liberty east from Chestnut 700 feet of six-inch pipe and two fire hydrants; on Charles south from Liberty 300 feet of four-inch pipe and one hydrant. All of the above pipes are connected with the high service. On Greenwood street have been laid 400 feet of four-inch pipe, with one hydrant, supplied from the low service.

OAKLAND & PIEDMONT RAILROAD.—Work upon the new railroad to run from Watts' tract to Piedmont is to be commenced as soon as the route is surveyed. At a recent meeting of the incorporators the following officers of the Oakland & Piedmont Railroad Company were elected: President, Walter Blair; Vice President, Horatio P. Livermore; Treasurer, Arthur W. Bowman; Secretary, W. H. Chickering.

THE IRON AND METAL MARKET.

PHILADELPHIA, AUG. 2.

This week's business has been confined to smaller lots of pig iron at last week's prices. Manufacturers refuse to make desired concessions. Offers have been made for 1,000 ton lots Forge, but were not accepted. Prices range nominally from $17 to $19 at furnace. Two or three 500 ton lots have sold at $18; smaller lots, $18.50. Special brands are not to be had. Stocks of inferior makes are moderately abundant. Foundry irons are $20@$21, for No. 2, and $22.50 is the average selling price for No. 1; the best grades are out of the market; Muck Bars average $34. A fresh lot of inquiries for Refined iron has come to hand, and negotiations for several hundred tons will be closed by Saturday. Selling price 2.20@2.25c. for small lots, and 2.15c. has taken a few large lots. Country mills are more disposed to make concessions than city mills. Common iron is in active demand and sales of several hundred tons are reported between 2@2.10c. Steel rails are firm and active at $38@$39. Large lots for winter delivery can be had at $37.50. Quite a number of inquiries are in hand, but as nothing is to be gained by placing orders now, and as makers are firm in their prices, buyers will wait for further developments. Nothing is being done in old material. Scrap is quiet and firm for good lots.

PITTSBURGH.

The past week has been very quiet with the exception of the feeling caused by the Ohio (Ward Co.) failure, but this will have but little effect on this market. The firm has been weak for a long time and the failure, apart from the little excitement in iron circles, produced no effect. Holders of pig iron are firmer in their views than for two or three months, but notwithstanding this fact, some sales have been made at very low figures by parties who are anxious for money. Mid irons sell at $17. The large supplies in hand hold buyers back. Foundry irons range from $19@$21. Bessemer sells in small lots at $21@$21.50. Railway material is in active request to fill requirements for the western end of the State. Orders have been placed at $39. Large blocks can be secured at $37.50. Old rails are wanted at $23.

The undertone of the market is satisfactory, and a few weeks will develop a sharp demand, as consumers are known to be short of supplies.

TRUSS BRIDGES.

John J. Alises devised his bridge for use as a portable bridge, to be used in swamps or marshes, so as to facilitate the passage of army, army wagons, etc., during the time of war.

This invention expired Oct. 4, 1881.

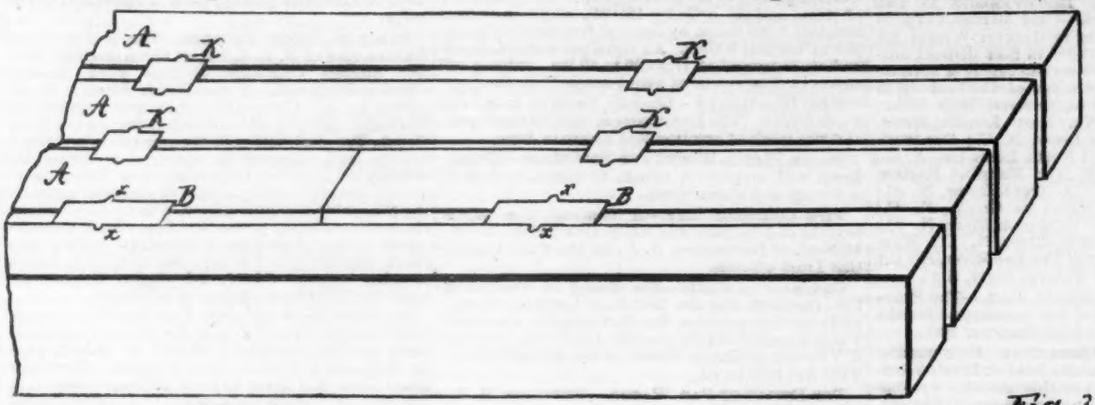


Fig. 1.

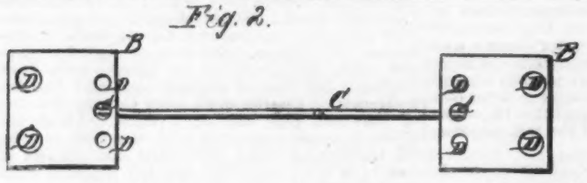


Fig. 2.

Fig. 3.

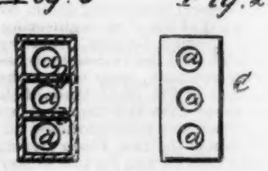
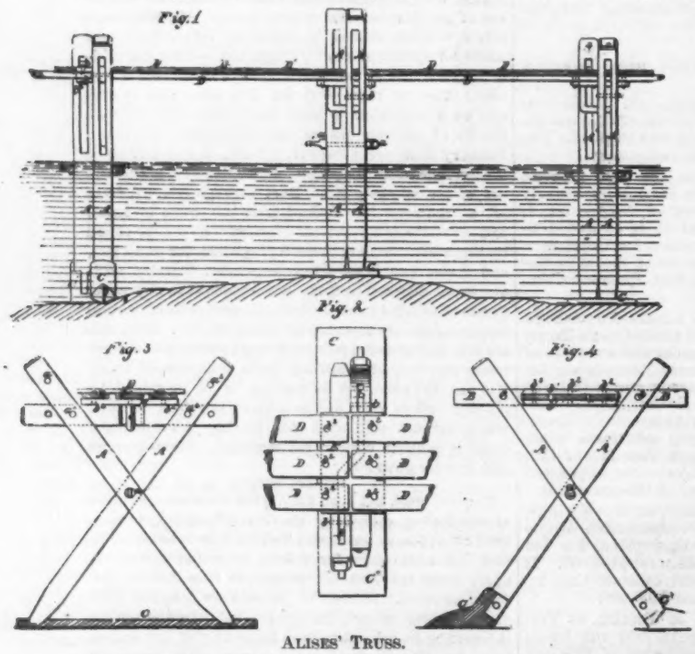


Fig. 4.

No. 1. CHAPIN'S CLAMP. (See page 351.) No. 2.

A represents piles or supports, two pairs of which, with their appurtenances, form one section of the bridge.

To obtain the requisite supporting area at top and adapt the bridge to remain in a steady and firm condition, the piles are crossed in pairs, thus forming a trestle. They are connected by a bolt *a* formed with eyes, in order that a connecting rod may, if desired, be employed longitudinally. In the upper ends of the piles are slots to receive the ties



ALISES' TRUSS.

B, serving as a coupling and brace at top. Holes are provided in the ties to receive the pins *b*, thus admitting of vertical adjustment of the ties *B*, for the purpose of bringing all the upper supporting points on a level, in cases where the bottom of the water-bed is undulating, as in Fig. 1.

Where the bottom is soft mud, the piles are prevented from sinking by the employment of broad, flat sills *C*, or by check blocks *C'* where the bottom is hard. *D* are the roadway sleepers.

May 30, 1865, John Boles, Jr., again comes forward as an inventor of a truss bridge.

This truss has a top chord *A*, a bottom chord *B*, two posts *C C*, and a series of vertical tie rods *D*. The bridge may also include an arched beam *E*. Extending from chord to chord are two series of curved braces *F F'*, each of which diverges from that next to it, on either side. One series is arranged in front of and in opposite directions to those of the other series. These braces may be semicircular, semi-elliptic, arcs of circles, or ovals or ellipses in form.

In Fig. 2 they are not only shown as divergent, but as overlapping one another. In this case the divergence of the braces causes the overlaps to be closer together near the bottom chord than they are near the top chord. This construction adds greatly to the strength of the truss.

Through the middle of the bottom chord, and from post to post, is run an iron rod or cable *a*, Figs. 3 and 4. A "lacing" *b* is also combined with the truss, which is extended from one post to another, and interlaced with the tie-rods, at or near their lower ends, and just above the chords. It is strengthened further, in the manner shown in Fig. 4, by having two cables crossing each other about the middle of the bottom chord, and supported by a series of struts *d* projecting down from the chord.

The next and last invention of John Boles, Jr., is dated May 30, 1865.

In this lattice truss, or truss which has diagonal braces and counter braces crossing each other so as to form quadrilateral openings, the invention consists in uniting each two straight braces, or a straight brace and a counter-brace, by curved or arched connections to be fastened to the chord at the union of the braces.

A and *B* are the top and bottom chords, and *C* and *D* are the braces arranged to cross each other as shown in the figure. The foot of each brace *C* is connected with that of each counter-brace *D*, by means of the curved connection or continuation of both of such braces, as shown at *a*, and is bolted to the bottom chord. This method of connection is held to be particularly useful, when the braces are made of thin iron bars.

Boles, Jr., arranges within each of the quadrilateral openings of the lower range, what he terms as a "diagonal upright strut *E*," which overlaps the braces and extends through the openings. They serve to prevent sagging of the truss, and contribute greatly to its strength as well as relieve from strain the bolts of the crossings to which the struts are connected.